1.1 Introduction

This book deals with human well-being in history: the growth of population and its economic welfare. For the most part it concerns itself with the economic and population changes of a part of the world that we would now consider long developed: Europe and North America. Only to a lesser extent does it deal with Asia and the southern hemisphere. Within this context it draws its evidence widely to emphasize the commonality of human experience. The aim of the book is to explore the relationships between the size of the population, the quality of life experienced and the economic circumstances that brought it about. It is an economic history of the human condition. It is not intended as a demographic history although many aspects of demographic change become part of the story. The book also focuses on the recent part of the human journey, since late medieval times to the present.

The entire history of human development is surprisingly short. Humans first migrated from their ancestral home in Africa about 50,000 years ago. This amounts to no more than about 2000 generations. The subsequent migrations have peopled the earth and, in the process, given rise to a wide variety of cultures, languages, economic, social and political arrangements. In these migratory wanderings, our human predecessors were continually faced with economic and social alternatives. Their goal was survival as individuals; survival as a species followed. So, throughout the centuries, humans have had to make choices. For example, should we continue to hunt here tomorrow or move to another (hopefully more plentiful) site? Each decision was constrained by factors that limited the range of available options. The outcome of their choices was uncertain and risky; some potential outcomes were undesirable. Collectively, the results of the decisions they made were themselves often modest, but of vital consequence. It is likely, however, that these small choices were systematic and
that the daily wanderings turned into migrations that spanned the earth. In such a fashion, the cumulative effects of these small decisions were major.

Sometimes these choices were made by individuals, but often they were made collectively as part of a larger social group – a family, tribe or nation. Since the decisions concerned survival and material well-being at the basic level of the provision of food, shelter and clothing, the correct choices were often life-preserving. This history analyzes some of these key choices and the constraints under which they were made that enabled humans to grow in numbers and expand over the continents. It also examines the historical consequences, intended and unintended, of these choices.

The social and economic well-being of both individuals and whole populations was influenced by environmental conditions and events over which there was no, or little, human control. Nature could be bountiful or miserly. The local availability of plants and animals for sustenance was a fundamental requirement. Pre-historic migrations sought out such areas. Other early humans stayed near the oceans where shellfish and other marine resources were available. But, over time, nature could be capricious. Long-term climate change altered migration patterns and, in northern Europe and Asia, forced humans to adapt their lives for survival in cooler conditions. The last expansion of the North American ice cap, for instance, appears to have blocked the spread of the Clovis people (a prehistoric culture from which most native North and South Americans are descended) into North America until its late phases, about 13000 years ago. The end of the ice age also brought about desertification in Northern Africa and made that area inhospitable for all but the hardiest of individuals.

Many environmental events were not of such a long-lived nature, and some environmental change was relatively abrupt in geological time. After the so-called warm late medieval period, the mean temperature in northern Europe (where we have measurements) began to fall. The Greenland Viking colonies disappeared (see Chapter Ten). Crops such as vines ceased to grow where they once did. The general effect was a shift, of any given climate zone, south by 300 to 400 miles. The Little Ice Age, as this cooling in the northern hemisphere came to be known, lasted about 450 years, to about 1850, a relatively short period in climate history. We might note that the agricultural and industrial revolutions of Europe are within this time envelope. Clearly, such environmental shifts required human adaptation. Fortunately, a key feature of modern human success was adaptability to environmental change, the ability to learn from, react to and occasionally manage the effects of some of these natural phenomena.

The most successful human adaptation to environmental change was the ability to cope with the annual climate cycle of the seasons. An early historical example is farming in the Nile Valley, which was only possible by learning how to use the river’s annual flood cycle. At a more prosaic level was the necessity of storing and rationing foodstuffs between the harvests. The abundance of certain food for short periods of the year meant that from the outset humans were required by circumstances to plan out their consumption. Ultimately, if humans could not move to the seasonably available food supply, they had to invent methods of preservation: drying and salting fish; pickling cabbage (as in northern China and Korea); curing meats, to name a few. Stocks of cereals not only had to be rationed over the yearly cycle but had to be stored and protected from rot and vermin requiring further adaptation in the technology of storage.
Some constraints limiting both the growth and improvement in the well-being of the human population were themselves of human origin. The summation of separate decisions determined how societies and their economies were organized. Each decision presumably was made for the greater good (in intent if not in practice), and these set limits on collective action. While the resulting societies undoubtedly met some sort of efficiency criteria (they would not have survived otherwise), they also constrained individual human action within them. Indeed, throughout most of human history, men and women were constrained to live much like their fathers and mothers had, occupied themselves with the same tasks and were assigned by birth to the same social rank. Systematic social and economic change is a condition of only the past few thousand years. Ubiquitous social and economic change is a product of only the past few hundred years. Yet, as noted earlier, humans proved to be adaptable, and occasionally individuals and societies managed to push against the constraints. Written and archaeological history is full of instances of discrete, permanent changes in the social, political and economic boundaries by human actions. Individuals departed from the norm – thought new thoughts, migrated to new areas and founded new societies. We would like to believe that these changes gave rise to greater individual well-being, but often they did not.

The natural environment also includes the constant human companions of microbes, both helpful and harmful. Many of the helpful ones are essential to our well-being, such as those that we acquire in the first hours of life and which are necessary for our digestive tracts to function. Only very recently have we learned how to manipulate microbes to our advantage, expanding the role of the helpful ones and limiting the effects of the harmful ones. The harmful ones have occasionally given rise to catastrophic events and have had a profound effect on the growth and well-being of the human population. A disease may threaten a community or devastate a tribe. However, these diseases were often widespread, occasionally worldwide in their effects. In the 20th century alone there were three such events. First was a bubonic plague (or possibly its pneumonic variety) in southern Asia, especially India, in the late 19th and early 20th centuries. The death rate in India was thus kept higher than it otherwise would have been in the early 20th century, hovering in the range of the birth rate (about 45 per 1000 of population). Second, the great influenza pandemic of 1918–9 took a huge toll of the world’s population, about 15 to 20%. Third, HIV/AIDS is a modern scourge currently endemic throughout the world but particularly severe in sub-Saharan Africa. In one of the countries most affected by the disease, South Africa, the life expectancy at birth is approximately one-half that in North America and Western Europe. Apart from sudden catastrophes there is also the ever-present endemic disease that may be survivable but debilitating to the affected individual. Disease is part of the human condition. It not only shortens life but reduces its quality.

In addition to the naturally occurring phenomena, there are human-inspired catastrophic events such as wars. Although they are preventable in some sense, to individuals caught up in them, these conflicts seem a force beyond their control. Stories of conflict between competing states and empires comprise some of our first written narratives. In times before such records, it is unlikely that human society was much different except in degree. Human conflict harms the individuals involved, but
the greater toll is much wider. It comes in the form of the consequences of crops not planted, families reduced to slavery or penury, and a rise in the dependency ratio (the number of people supported by a worker). It is often noted that, before modern times, wars were limited in their negative effects. The Wars of the Roses in England (1455–85) lasted for about 30 years but only consisted of 13 weeks of campaigning and battles. Furthermore, it is argued of most wars prior to the modern period that the campaigns involved only a small part of the geography. Most areas were unaffected by the battles and the pillaging. But, if we account appropriately for all the indirect effects of these “limited” wars, the costs were likely much larger than that suggested by most historians. Farmers’ absence from the land at critical times resulted in lost output, investment in war material that would otherwise have been directed to productive uses and so on. Even then, and in contrast, the major wars of the 19th and 20th centuries have been of a fundamentally different nature than those of earlier times in terms of the widespread scope of the conflict, the greater geography of the battlefield and the number of direct and indirect casualties.5

We can think of the well-being of individuals and groups having several distinct features. First is the basic standard of life in terms of food, clothing and housing or what we might call necessities. These necessities take a declining proportion of individual family budgets as personal income rises (i.e., they have a low income elasticity of demand). Second, economists argue that the increasing quantity and quality of goods consumed by individuals through time, is evidence of improved well-being. Through most of human history more consumption normally meant better lives. Improvements in well-being, and particularly the rise of nutritional standards, also led to the prolonging of life, the reduction of disease and suffering, and minimizing the amount of preventable death. These, and other matters of health, are generally the product of more affluent societies. One of the striking differences between modern advanced economies and historical ones is the cause of death. In economically advanced societies most people die as a result of aging. In earlier times trauma (violence, accident, starvation) and communicable disease were the main killers.

The increase in individual consumption was only achieved, however, at some social cost to society at large, the most obvious of which was environmental harm. From the beginning of the industrial revolution in the 18th century, this has been a persistent problem. It has proven to be difficult to solve because of a lack of incentives facing polluters, a lack of will on the part of the state (which often tends to undervalue the environmental degradation), and a lack of policy tools to control the pollution and minimize its damage. While the scale of modern pollution is a product of industrial growth it is not simply a modern problem – an upstream leather mill from pre-industrial times may pollute the water course and make use of the water downstream hazardous for drinking. Another major social cost in achieving higher rates of individual consumption is the over-exploitation of certain natural resources. For instance, we over-fish, causing the stock to decline leaving fewer fish for future harvests. Individuals are mortal, and, even though they may care for the future consumption of their grandchildren, today’s consumption tends to be given greater weight.6 This is a trade-off: more consumption today at the expense of that tomorrow. Society as a whole, however, may consider future well-being as being more important than does the individual. Today, in the mass consumption societies of Europe and
North America, there is the well-known revulsion to some aspects of individual consumption. Mass consumption means mass disposal of waste, which has, in turn, a deleterious environmental effect. While these are genuine concerns, they are also largely concerns of more recent times.

In tracing the human population and its well-being there are several overarching issues:

- What historical conditions gave rise to the growth of the human population?
- What were the consequences of population growth?
- What were the improvements in the human condition in terms of survival and length of life, and how were they connected to material well-being (consumption)?
- What brought about the restlessness of the human population that led to migration?

The consideration of these questions is the economic history of population change, of the human condition.

1.2 Human Origins

The general humanoid genus probably first appeared on the landscape about 1.5 million years ago in sub-Saharan Africa. Early humanoids gave way to the successful *homo erectus* about 0.5 million years ago, and this species spread from the African heartland to the Middle East, Asia and Europe. It then died out. Another variety, the Neanderthal humans, successfully populated Europe and Western Eurasia where they remained for many thousands of years. We, modern humans are a different branch of the same family called *homo sapiens* who also originated in sub-Saharan Africa but just more than 150–200,000 years ago. (There is some dispute about the exact dating.) There, *homo sapiens* remained until the relatively recent past, about 50,000 BC, as noted earlier. The migrations of our direct ancestors continued once they reached Eurasia. They then spread as far as Australia and through central Asia and China relatively rapidly. Others went westward into Europe, and yet others eastward over the Bering Sea land bridge into the Americas. When modern humans reached Europe in their migrations they were met by the earlier Neanderthal types – although the numbers involved must have been quite small. In Western Asia and Europe, Neanderthals and *homo sapiens* lived side by side for many generations, although eventually the Neanderthals disappeared and became somewhat of an anthropological mystery. Some may have inter-bred with humans but the evidence for this is meager. More than likely they died out in the competition with modern humans for the scarce food resources.7

Modern humans today display differences in language, culture, and society. Yet, despite superficial physical characteristics such as skin color, shape of eyes and others, we all carry basically the same genetic characteristics; all modern humans are, in more than a literal sense, cousins. Every person in the world alive today traces their origins to one particular woman who lived 80–160,000 years ago in Africa. Naturally, she is called “Eve.”8 This raises two issues. First, how do we know this to be so? Second, does
this mean that the emergence of modern humans depended critically on just one person? We can answer both questions with the same explanation. Eve was indeed a real person, an early *homo sapien* woman. But in locating Eve historically we also find that she is a statistical construct. Our knowledge of Eve derives from human genetic sequences.

All women, but not men, pass on a substance called mitochondrial DNA [mtDNA]. This exists within the cell but is separate from the cell nucleus. As such, the mtDNA is passed only from the mother to her female offspring intact through the generations. The mtDNA is subject to very infrequent mutation, known as markers, which permit the identification of many generations of women. So how do all women today have the mtDNA that permit tracing back to a common type? Figure 1.1 helps explain this. There were probably several women who were candidates to be Eve, each with distinct mtDNA. Two are shown in Figure 1.1. Only Eve’s mtDNA survives because only she had female children who survive her, and who, in turn, had female descendants that lived through the generations. Although the probability of a woman giving birth to a female child is approximately the same as that of giving birth to a male child (prob. = 0.5), in any one family there may be departures from this central tendency (as is the case for the third generation in the figure). The non-Eve female’s mtDNA simply dies out in her branch of the family tree. Note that Eve’s great grandson may marry (breed with) a woman with different mtDNA from his mother, but this has no effect on his female children as the only important relationship is the mother-daughter one.

If we are all descended from Eve, was there an Adam? Anthropologists conjecture that there were about eight potential Eves and probably slightly more potential Adams. Sadly, however, Adam and Eve never knew each other as they lived many thousands of years apart. Tracking males into deep history is done by examining the Y chromosome, which is exclusively a male attribute and is passed intact from father to son. In this case, we can examine the nucleus of the DNA itself by the sequence of genetic codes. The male Y chromosome sequence is subject to more frequent and random mutations than the mtDNA also called markers. What is important for tracking the human population is that the genetic codes carry the history of all previous mutations. So for males, unlike the case for females, we can actually track human history over relatively short periods of time. If a marker distinguishes the central Asian male from, say, the east Asian male, we can determine which was closer to African roots.
Since we are all basically the same, it might be expected that we have common instincts and reactions, tempered of course by cultural and environmental differences. Racial distinctiveness, once thought to be an important attribute within the human species, is now argued, given the DNA evidence, to be the product of very recent history. It is probably in some large measure a local, slight evolutionary response to the physical environment, one that is continually changing. Not only does race not distinguish one human from another very well outside social markers, it is ephemeral. Certain characteristics appear among groups depending on where they originate in the genetic mutation sequence. For instance, the appearance of the HIV/AIDS blocker, itself a mutation, known as CCR5-delta 32, is only found subsequent to the appearance of the marker that separates Europeans from others, Europeans being very late arrivals. However, this is a result of random genetic mutations that do not depend on racial characteristics. It is simply a matter of geography and timing.

1.3 The 40 000 Years to 10 000 BC

Once out-of-Africa, the human population migrated in relatively small hunting and gathering groups. Animals were sought for their protein/fat value and the use of their pelts as clothing. Bone and antlers were made into fishhooks, scrapers, and needles for sewing and animal gut for binding. Foodstuff was also gathered from nature in the form of berries, edible plants and their roots. Recent evidence suggests that, since 26 000 BC in the Middle East, the harvests of kernels from wild grasses were ground to make a type of flour used for baking a type of flat bread. Nature also provided stone, especially flint, for the advanced tool making of arrows, axes and spearheads. In fact, there is no point of historical observation when *homo sapiens* were not toolmakers. And for most of the period fire was mastered and used for warmth, light and cooking.

Modern humans were capable of abstract thought according to the evidence of petro-glyphs and cave painting, such as those at Lescaux. No such record is evident for the earlier Neanderthals. Abstract thought is a prerequisite for planning. That is, modern humans thought ahead about their activities of hunting and gathering rather than just being hostages to fortune. They saw opportunities and made choices. One inference is obvious: if *homo sapien* groups thought about the future, social groups were likely structured to be reasonably effective hunting/gathering units. Indeed, mankind was so successful at hunting that they were likely responsible for widespread extinction of some animal species, the easily pursued European woolly mammoth being one. Archaeological evidence also suggests that early mankind was a complex social being capable of compassion and a sense of community (or family). Skeletal remains of a severely physically malformed young woman dating back many tens of thousands of years have been found in Pakistan. The malformation was a condition of birth. This individual could not have survived without constant care and feeding. That she survived into young adulthood could only have been the result of extensive family nurturing.

Early human population growth was subject to the availability of edible vegetation and wild animal prey. In this sense, humans were no different from other animal
species although they were not systematically the prey of a superior predator. When a biological population is small, its growth is not very rapid, even when the environment can provide ample habitat and sustenance, as in Figure 1.2. (The growth, at any particular point in time, is taken as the slope of a tangent to the population curve.) At the other extreme, when the population of hunter/gatherers grows large, it is constrained by the carrying capacity of the environment – the availability of foodstuffs and clothing resources. From its small size the population grows and, as it does, it grows more rapidly. At some point, however, the growth will slow down as survival becomes more precarious for some individuals. On a per capita basis, the amount of food and necessities provided in a state of nature declines with the result that fewer progeny survive. At the theoretical limit, the environment cannot even absorb one more individual. At the maximum population carrying capacity of the environment, one individual has to die to make room for one new individual. The overall growth pattern that describes this growth is an “S” or logistic curve of population size over time. The carrying capacity is defined as a fixed technology. The upward shift indicated by the arrow illustrates the effects of a new technology or more available resources.

Figure 1.2 Logistic Growth.

Note: The carrying capacity of the environment is for a fixed technology. The upward shift indicated by the arrow illustrates the effect of a new technology or more available resources.
terms, raising the *transaction cost* of family formation. Presumably the antipathies that arose out of competition among groups meant that the surplus males and females of any one group could not easily link with those of another. This limited procreation and family formation. Indeed, groups of humans might drive others beyond the local economic margin thereby eliminating them as competitors in the search for resources.

Over long periods of time, the resource constraint was not a fixed limit, but shifted up (or down) in terms of Figure 1.2. For instance, beneficial changes in climate, noted earlier, might improve the growth of the plant and animal resources on which humans directly depended. An upward movement of the resource constraint allowed the human population the scope to expand. The opposite might indeed be the case, and there is some evidence of climatic change that adversely affected human and other animal populations. At some stages in the 40 000 years after leaving Africa, the human population may have become extremely small, perhaps close to extinction. But the resource constraint might also change because of human inventiveness. Note that even in a hunter/gatherer society there is scope for one of humans’ greatest abilities, the application of planning and the seeking of technological relief from the resource limit. For instance, some human groups engaged in systematic fishing and hunting techniques which were refined and made more efficient. Groups migrated regularly in an annual pattern to where resources were more plentiful at a particular time of the year. The local scarcity of nature was overcome.

In the course of this 40 000 or so years, the human population as a whole grew, but it was still small at the advent of arable agriculture. Despite local population pressure in areas such as the Middle East about 10 000 years ago, only about 5 million people lived on earth in the year 8000 BC (estimates of early populations are necessarily imperfect). The entire population of the earth was about the size of the Houston metropolitan area today. Or, put another way, today’s population of Greater Shanghai is six times the number of people on the earth 10 000 years ago. The population of the world today is about 6.885 billion (2010).

### 1.4 The Last 12 000 Years

About 10 to 12 000 years ago, some hunter/gatherers gave up their nomadic way of life. They took to domesticating wild grasses and ruminant animals – the dog was already a human companion. Semi-nomadic at first, a sedentary population of farmers first appeared in the Euphrates-Tigris region (modern northern Iraq). Exactly what determined this shift from nomadic hunting/gathering to farming is not understood. Several conjectures have been made:

- The natural resources on which life depended were being depleted due to rising human numbers in that location (density of population).
- The weather pattern (northern hemisphere warming) precipitated the shift.
- Agriculture represented a superior alternative to hunting/gathering.

In Northern Iraq the first urban settlements emerged. One of the most ancient is the town of Ur, the reputed birthplace of the biblical Abraham. Undoubtedly the
transition from a hunter/gathering society to a settled one took many generations, perhaps many hundreds of years. Nor did farming entirely displace the old activity of hunting and gathering. These continued, but now did so from a fixed base, presumably with decreasing success. With early agriculture there is the first evidence of writing and counting. As it turns out, literacy and numeracy are a response to the mundane need to count sheep and note quantities of grain. Indeed, there were a whole range of economic specializations that emerged as the new farming villages provided a ready market for specific goods and services.

Some economic anthropologists argue that the switch from a peripatetic hunting/gathering society to a sedentary, agricultural one brought about a lowering of long-run material well-being. On farms and in the new village communities, disease (often the result of living close to domesticated animals) was more common. Humans became shorter in stature, a sign that there was a decline in nutritional standards. Life expectancy at birth probably declined somewhat. People, we presume, would not choose these outcomes either if they were aware of them or if there were alternatives to a lower standard of life. Of course, the decision that faced those who gave up hunting/gathering was not that of rejecting a plentiful nature for an agricultural alternative, but one of rejecting a way of life that was increasingly uncertain. The relatively greater nutritional certainty was responsible for a substantial, but unknown, growth of the population despite the increased hazards of a settled life.

Yet, the long-run rate of growth of the world’s population until very recently was extremely low. From 8000 BC to 1 AD it was 0.0512% per year on average, only slightly more than the growth for the first 40,000 years (0.0351%). Subsequently, for the next 1200 years, the growth rate was even lower. And it fell even further in the European medieval/Renaissance periods (c.1200–1650) and the Yuan and Ming dynasty periods in China (1271–1644). Long-run rates of growth can, however, be misleading because they do not account for shocks to the world’s population. Earlier, we noted that the climate variations in the first 40,000 years probably wreaked havoc when they occurred. In the years from 1 AD to 1650 there were large shocks in the form of worldwide fatal diseases (pandemics). One of these occurred in the reign of the Roman Emperor Justinian (541 AD); it claimed a large, but unknown percentage of the people alive at that time. On slightly safer statistical grounds, the Black Death of the late 14th century took a toll of one-quarter to one-third of the entire world population (see Chapter Ten). Such instances, and many more that were less extensive in their effect, mean that the world’s population was growing much more rapidly on a year to year basis than the low long-run rates suggest but that these shocks suddenly, and catastrophically, reduced the population. That is, there is much in human population history that suggests uneven growth.

From Figure 1.3 we can model how mortality shocks might affect population size over a 100 year period. First, the population is assumed to be 50 million and grows at a compound rate of 0.5%. Over 100 years the population grows to 82 million. However, with the same base population and over the same period, if the rate of growth was 0.75% then the terminal population would be 105 million. Now assume that the rate of growth is 0.75% but that in year 51 there is a mortality shock that kills 22.5% of the world population. The resulting population in year 100 is the same as it
would have been with the lower growth rate with no mortality shocks. By similar modeling, a year-to-year growth of 0.75% but with two mortality shocks each of 12.5% of the population in years 34 and 68 produces the same result as the former case. Thus, in the three different cases the long-run measured rate of growth using the initial and terminal observations is 0.5%.

The models in Figure 1.3 are necessarily quite simple. When confronted with the history of growth and population shocks some further questions have to be asked. For instance, does the growth of well-being (or income) expand at the same rate as the population? If it does not, who gains and who loses and how? Changes in income and its distribution might affect the overall rate of population growth. There are also modeling issues which, when accounted for, help provide greater reality. It is unlikely, for instance, that mortality shocks affected everyone in the same way. Vulnerable groups might include women, children and the elderly more than able-bodied males. It is unlikely then that we could assume that the immediate post-crisis population growth simply picked up at the same rate as existed before the mortality shock. We will return to this later.

From about 1650 the rate of growth of the world’s population increased dramatically, at a multiple of the earlier rates – see the estimates of world population in Table 1.1. Although we cannot identify particular turning points from this evidence, after 1650 the rate of population growth was 0.465% (compared to 0.0240% in the previous 450 years). In a general way these changes in the rate of growth of the human
### Table 1.1  Estimates of the World Population, 10 000 BC to 2050.

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**Notes:** Lower and Upper Bound estimates are the lowest and highest estimates from the literature noted. Where only one estimate is available it is listed as the lower bound one except for the recent period where the UN Population Division Medium estimates are the only ones and are consistent with the earlier upper bound estimates.

**Sources:** The table is constructed from material assembled by the US Census Bureau: US Census Bureau (2006), United Nations (1999) Table 1 and United Nations (current) Population Prospects – see General Sources.

For the world as a whole there is only one source of population growth, the net difference between births and deaths. However, for any country or region (or tribe or family) the net of births and deaths are supplemented by the addition of newcomers (immigrants) and diminished by the departures of existing members of population coincide, as noted earlier, with the coming of the agricultural revolution and, later, the industrial revolution in Northern Europe and the spread of these ideas beyond. In the 20th century the growth rate has yet again increased to 1.305% as a result of this spread into Africa and Asia. Carl Haub estimates that the number of people who have ever lived on earth totals about 106.486 billion. This means that 5.8% of everyone who has ever lived is alive today. If this unprecedented population growth of recent years was a product of i) an improvement in individual incomes; ii) technological advance; and iii) modern medicine, which came first?

### 1.5 A Few Fundamentals of Population Growth

For the world as a whole there is only one source of population growth, the net difference between births and deaths. However, for any country or region (or tribe or family) the net of births and deaths are supplemented by the addition of newcomers (immigrants) and diminished by the departures of existing members of
Overview

the group (emigration). Thus, apart from the global counting, population change is the sum of the net natural increase and net migration:

\[ \Delta \text{Population} = (\text{Births} - \text{Deaths}) + (\text{Immigration} - \text{Emigration}) \]
\[ = \text{Net natural increase} + \text{Net migration} \]

As indicated earlier, there is no requirement that these terms be positive or that population change be positive. The two basic net balances may reinforce one another by either increasing or declining together. They may also work in different directions. Later we will examine historical examples of all three possibilities. Not surprisingly, the two net balances are linked by more than arithmetic. Consider the cases of modern Canada and Australia, amongst other countries, whose net natural increase has been declining sharply in recent decades prompting governments to promote immigration. All of the components of population growth (right hand side of identity above) are influenced by the state of material well-being, although to different degrees and in different ways, as we shall see. Growth rates are also influenced by other external economic conditions. For instance, international migration has historically been governed by the cost of travel to and establishment in the country of destination – transaction costs again. Some of the forces that influence the four basic items of the population identity may be scientific (birth control), social (marriage prohibitions and taboos) or political in origin (the level of immigration). Despite their appearance, most of these effects can be analyzed within the framework of economic analysis because they involve “a choice among alternatives.”

1.6 The Quality and Quantity of Life

The United Nations each year publishes a quality of life index for most countries. The Human Development Index is a construct that assigns numerical values to vastly different characteristics and then adds these values to produce an overall (weighed) index. Countries are then ranked by the value of the index. The standard reaction of national governments is to point with pride to their high or rising position or to denounce the index as meaningless if their position in the rank ordering is low or falling. In addition, some of the individual characteristics that comprise the index are, by themselves, useful but separate measures of the quantity and quality of life and deserve attention.

It is only in very recent times that we have broad-based information about whole populations. These are referred to as national aggregates. Statistical profiles can also be defined for sub-groups within that population using census or large scale survey data – as seen in the following chapter. If there are difficulties measuring the quality of life today these difficulties are even greater when we try to measure it historically. As a general rule, the deeper we delve into history, the less complete our population and economic information becomes. There are some exceptions, but they are rare. There are two main types of comparability of the quantity and quality of life that are of interest. First, were individuals (or groups or populations) better- or worse-off over time? This is referred to as time series analysis. How does the quality of life of
textile workers in Lancashire change over the course of the 19th century? Often we are interested in comparisons, not over time, but between individuals or groups. For example, were tenant farmers worse-off than freehold farmers in colonial America of 1770? This involves looking at a *cross-section* of the population information, in this example, by the characteristic of land tenure. Such questions beg the issue of which individuals fall into our sample and raises problems of statistical comparability. Last, we may wish to combine the cross-section and time series analysis and look at the changing quality of life of comparison groups over time.

We take the “quantity of life” to mean the length of life. There are a variety of different perspectives on longevity – how long a person lives or how long an individual might be expected to live. The measure most commonly used is the expected life of an average person at the point of birth. In historical times, and today, women tended to have longer average lives than men, so we may wish to calculate the life expectancy separately by gender. A unisex life expectancy will *overstate* the length of time that males will live and *understate* how long females live. Nonetheless, calculating the quantity of an individual’s life is, in theory, straightforward. The simple counting does, however, raise some perplexing issues. The most obvious of these is the question of how we deal with the instance of children dying at the point of being born. Should we think of this neo-natal mortality as being a short quantity of life for the poor unfortunates whose lives are only seconds or minutes long or should we think of it as a quality of life issue for the mother (or family) who loses the newborn child? It is both. The length of life and its quality are highly related. This is not at all surprising as both child and adult health, and therefore survival prospects, depend on nutritional levels and housing provision among other things. Even if life is not shortened by poor standards of material well-being, a life that is relatively free of disease and pain is of a higher quality than one in which disease and debilitation is common.

From a strictly economic point-of-view, a person crippled by a disease (or trauma) normally has a lower working productivity. National productivity (or national income growth) will be lower as a consequence. The individual affected will likely have a lower income. If pain and suffering lower the quality of life so too does psychological stress. A life where the uncertainty of minimal survival income is greater is a poorer quality life than that where there is less uncertainty. In general, we argue that the quality of an individual’s life improves with the rise in consumption. This consumption comes about by the rise in income, which has to be measured in real, as opposed to nominal, terms in order to adjust for the movement in prices over time. A decline in prices with a constant nominal income will also produce a consumption gain. For instance, we can observe that the long-run nominal price of a bushel of wheat in the world’s main commodity markets has changed very little over the past two hundred years giving rise to a much lower real price. Furthermore, the prices of basic grain and flour in far locations have tended to converge on those in the main commodity centers reducing these regional prices to an even greater extent – a benefit of globalization. *Private consumption* then increases with real income gains. But increases in the quality of life may also be attributed to increasing levels of *collectively consumed* goods and services, those parts of consumption from which no one can be arbitrarily excluded. This is the case of the “public goods.”
We are also better-off in some fundamental ways that capture the improved quality of our lives:

- **Freedom from bondage.** Slavery and serfdom of various forms have frequently been part of human society and individuals were denied the most basic of family, work and mobility rights. No country in the world now legally sanctions slavery.
- **A greater range of choice of both goods and services.** Not only does competition among suppliers tend to produce lower prices for a good of a certain quality, but it produces a range of quality and price alternatives.
- **Greater occupational and social mobility.** When individuals face fewer barriers to occupation status there is a greater likelihood that individual investment in education will pay off. Furthermore, since some of these barriers are arbitrary (such as limitations by gender, race and class) the reduction or elimination of them provides the incentive for educational investment.
- **Greater participation in society and its government.** Not only is this freedom an end in itself but it also gives individuals some advisory power, through the ballot, on the provision of public goods and appropriate taxing policy to pay for them.
- **Greater range of choice in social interactions.** In most countries today we are used to meeting many more people even in the course of a single day than our ancestors might have met in lifetime. We interact with many more. This gives us a richness of human experience from the casual to the more intimate, compared to our ancestors (perhaps as recently as our grandparents).

### 1.7 The English Parson, Thomas Malthus

In 1798, an English parson named Thomas Malthus published a pamphlet called *Essay on the Principle of Population*.\(^{18}\) Expanded and reissued in 1803, it was the first systematic inquiry into the nature of population growth. It made Malthus an instant and controversial celebrity. The book conjectures that human breeding would, if left unchecked, expand at a geometric rate whereas the means to sustain the population would expand at only an arithmetic rate. At the limit, adjusting to the increased supply of labor, wages would provide an income that was below subsistence. The economy about which Malthus was thinking was principally an agricultural one. Malthus’ observations were also a theory of class behavior as, in his view, it was the “working class” that had this tendency to unrestrained breeding. According to Malthus, they had not yet discovered alternative consumption; any extra income simply reduced the overall death rate, part of which was an increased survival rate of the very young. Since, again at the limit, the wages could not support the population, there would be a resulting increase in mortality. He referred to this mortality increase (famine and disease) as a *positive check* on population growth.\(^{19}\)

The long-run (unstable) equilibrium, according to Malthus, was one where income in the form of wages always grew less rapidly than population. Over time the population size would oscillate around the subsistence wage, always driving the population back to the level supported by subsistence wages, always responding to unrestrained growth when the wage was above subsistence. This was a dismal view of human society with an urge to procreate that was quite animal in nature.
The Malthusian Cycle: Population living below the subsistence wage → mortality and smaller population → increased real wages → improved living standards → increase in number of children → greater population → reduction of real wages.

The only solution lay in preventative checks. These were actions that reduced family fertility. Malthus himself thought that a rise in the age of marriage would be a powerful check. Of course, there would have to be a clear economic incentive for this if preventive checks were to be effective. The working class, he insisted, would have to become aware of the benefits that could accrue in a better-than-subsistence-wage world. Proscriptively, the working class had to be saved from their tendency of unrestrained breeding. Formal education might help awareness, but Malthus’ main hope was that the workers would come to enjoy the extra consumption benefits possible from having fewer children to support. Should his hope not be realized, population growth would remain a problem. In some broad sense Malthus’ solution to the population problem was for the working class to become more bourgeois in their tastes and attitude. While this was a paternalistic solution, Malthus was undoubtedly correct to observe that having children and increasing per capita consumption were, at the level of the family, competing interests. He was also right, although for the wrong reasons, that an increase in aggregate real income was not always matched by a similar increase in real income per worker.

The Malthusian scheme was undoubtedly wrong in its prediction that the rate of population growth would always outstrip the growth of wages (income). First, Malthus’ conjecture was largely based on the behavior of the birth rate. Changes in the death rate played no significant role in his analysis except as a passive response to real wages and privation – a positive check. Furthermore, we might note, a decline in mortality does not automatically cause an increase in the supply of labor thereby depressing the real wage (it depends whose lives are saved). Second, while well aware of the industrial revolution that was happening all around him, Malthus was largely thinking of an economy with a fixed resource (land) base. Next, his theory of population was one without significant technical change (productivity growth) either in agriculture or the newly emerging activity of the industrial revolution – which in retrospect we know to be an on-going feature of industrial economies. Lastly, Malthus did not allow for factor substitution, that is he did not allow the factor proportions in production to vary over time. Economic history shows that the way in which factors are combined is fixed only in the short-run. In the long-run factor proportions are variable and tend to be employed in proportion to relative factor prices, one of which is the price (wage) of labor.

Unfortunately for Malthus’ reputation, he is often misunderstood and misrepresented by historians who often refer to “Malthusian populations.” In practice, there is little evidence that historical populations of any size have ever reached the Malthusian extremes. Most observation seems to support the view that, as Malthusian pressure exerted itself, human populations responded directly by limiting fertility, migrating or by indirectly finding other solutions in increased output. The crisis of
the Malthusian limit was seldom, if ever, reached except during periods of sudden shocks such as a famine or an outbreak of disease.\textsuperscript{20}

\section*{1.8 Measurement and Inference}

Most of the evidence on the size and economic condition of the human population is indirect. The modern practice of taking a (large) population census dates from the late 18th century and was not refined to a reasonable standard of accuracy until the 19th century. To be sure at various times prior to this, there were occasional attempts at counting populations, but they were either very small populations or the counting was flawed. Few of these earlier attempts, for instance, include women or children. Thus, for most of history, our information about the size of the population is inferred from records that were gathered for other purposes such as taxation. We are similarly in difficulty measuring the well-being of any population. Knowing how much food a royal household consumed in ancient Egypt gives us very little information about the standard-of-living of ordinary folk; but it does give us some. For instance, we know that the nobles’ diets likely defined the upper range of choice for that society. But, in general, most people and their standard-of-living in history have gone unobserved by the official records of their day.

Often it is reasonable to draw inferences about the population even when our evidence is selective or even biased. Let’s imagine that we only know the number of males in a society and have evidence about their ages. The age distribution of these males is what we would expect of a well-balanced population. We also know that the historical gender ratio is 978/1000 males to females for populations in normal circumstances. Based on the assumption that the unobserved females would also have a well-balanced age distribution (but different from that of the males because of the longer life spans of women) we can infer that for every 978 males there were 1000 females. If the male population is 1546987, then the total population is estimated as 3128773, the difference being the unobserved females. Such a calculation is highly dependent on the assumptions about the unobserved females and the gender ratio.

Not only is the available historical evidence indirect, but it is usually a sample of the population. The sample varies from the representative to the biased with respect to the overall population. For instance, if we use information in the wills of farmers gathered from a probate court archive, the sample is biased in several ways. First, farmers represent only a proportion of the working population (which varies through time). This limits their broader applicability. Second, they are old. Wills are probated upon death when the farmer’s estate generally was in a declining phase. Third, most farmers did not leave wills because their legacies were either too small or non-existent. Also, in most jurisdictions until fairly recently, married females had no, or few, inheritable rights. So we are restricted to the well-off males. Last, while the wealth left through the will represented the accumulated or stock of assets, it informs us about income flow only by inference.

Let us consider some of the historical records which contain selective, but still useful, information about the number of individuals and some aspects of their economic circumstances.
A. **Tax Records.** The functioning of a state always requires expenditures funded from revenue (or debt). This revenue can be gathered indirectly (as a tax upon goods) or directly (as a tax upon individuals, their consumption or income). From early records we gather information about taxes levied and the people who paid them. The first of these records go back 4500 years for the Middle East and are written in the ancient script of cuneiform. The Roman Empire was a great tax-gathering machine, but their records are very incomplete and only survive in fragmentary form. Modern governments use tax records, amongst other things, to monitor the migratory movements within the country during inter-censal periods.

B. **Probate Records.** These are documents that catalogue the transfer of assets on the death of an individual. Wills and supporting documents are the most common and are usually made legally effective by the judgment of a probate court. Since the state had an interest in the transfer for tax reasons, probate courts have a long history in many countries. But of course, only the wealthy had sufficient assets, so with these records we do not have a balanced view; most folk in history had so little, or nothing, to bequeath that a legal will was unnecessary.

C. **Military Records.** Organized armies, as opposed to hordes, normally have kept basic records on recruiting location (or birthplace), age, height and weight. Some of these records are extremely complete. Perhaps, the greatest set, prior to the 20th century, are those of the Union Army of the US Civil War era. Veterans were eligible for benefits including medical care so we can track them through their lives as well as learn a great deal about their recruitment characteristics.

D. **Hospital, Charity and Institutional Records (Workhouses).** Important studies have often used these sources. For instance, the birth weights of infants over a century have been studied by the historian Peter Ward using the hospital admitting and birth records of many hospitals in North America and Europe – see Chapter Eight. Who were the Victorian-age poor of the English workhouses? Dickens alone will not do!

E. **Shipping Records.** Occasionally, we know a great deal about numbers and little that identifies the individual. From shipping records the volume of the 18th century slave trade has been quite well documented. But, in the mid-19th century many countries required shipping records of passengers, and so from that time on we can trace the movement of individual people to North America. Port of entry records in the United States, Australia, Canada and New Zealand recorded the landing of individuals from ships.

F. **Church Records.** In many jurisdictions, and at various times, the registration of baptisms, deaths and marriages was a church-related function. (The historical records of individual monasteries and nunneries also provide interesting detail of their small communities.)

Yet it is the parish records of baptism, marriages and deaths that have proven most historically useful. Even although they vary in completeness the parish registers are an invaluable source of these “vital statistics.” From them accurate pictures can be built up for specific locations for various periods in history. The reconstruction of family histories using the parish records, and their amalgamation, has been a popular and
highly successful method of recovering the past. Our best understanding of the overall population change in England prior to the era of the modern census comes from the family re-construction work of the Cambridge Group led by E. (Tony) Wrigley and Roger Schofield.23

G. Others. Widely introduced in the 19th century were labor reports whose explicit task was to monitor the health and welfare of the ordinary citizens. These exist for many European and North American countries. Not surprisingly, the 19th century national statisticians often co-operated with one another so that one can find comparative data that are roughly similar in scope and reporting in several jurisdictions. The Bureau of Labor Statistics pioneered this work in the US. Modern governments have extended their concern to cover a great deal of labor market activity.

Demographers have often used sources in ingenuous ways to collect information. Tombstones and obituaries are among those employed successfully. Archaeological evidence is particularly useful for gauging ancient populations. Genealogical records of family or clan histories can be very useful for estimating long-run demographic trends. In China where dynastic histories are sometimes very thorough and extensive in their coverage clan genealogies sometimes go back 2000 years.

H. Other Modern Sources. There are a great number of modern sources, usually governmental, that contain important information on certain subjects: the leisure surveys, discrimination in the workplace and so on. International agencies such as the OECD (Organization for Economic Co-operation and Development) and the various arms of the United Nations also collect and collate information on a broad international basis, sometimes a world-wide basis.24

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Some Terms

*Time series data*: refers to information that appears in a regular, fixed-interval sequence. For instance: an annual measurement of the number of diphtheria cases in a certain location; the monthly price of wheat in a market for a given period; and so on.

*Cross-sectional data*: data that are from a fixed moment in time (such as the census) but vary by some other characteristic. For instance: the death rate by country; the ownership of indoor plumbing by income class; and so on.

*Panel (combination of time series — cross-sectional) data*: data that are both time series and cross-sectional are referred to as Panel Data. For instance: the average level of education (in years) in OECD countries for the period 1990–2006; the proportion of total land in farm by state for the census years 1850–1921; and so on.

*Representative sample data*: from a large population (or the entire data set) a sub-group is selected that is broadly representative. For instance, if we wish to calculate an average wage, we would not normally include children, but we would include women and men in proportion to their appearance in the labor force. This is often called *weighting the sample*. In this fashion, limited sample data are used to represent workers.
Let us imagine that, in a historical study, we have a representative sample, say the average (real) wage of textile workers in 18th century England. If we want to draw inferences about the standard of living afforded by that wage as it changes over time, care must be exercised. Caution is needed because the historical actors age over time. Younger workers typically earn less than the average, and older workers earn more. For instance, if the reported wage is constant over time, our representative worker is getting better-off as he ages from a younger to older worker.

Cohort data: when we take these life cycle effects into account we will often use a cohort analysis. For instance: the current occupational status of all those who graduated from Princeton University in 1963; the fertility of all females over time who first appeared in the census in 1801; and so on.

1.9 The Census

Of all the sources which inform us about population size only one was (is) direct. These are the censuses. Needless to say, the historical censuses were far from complete or accurate. Perhaps the most renowned of the early censuses was that conducted by William I, the Norman conqueror of Saxon England after his victory in 1066. The new king wanted a detailed list of the resources acquired with his new kingdom. Sometime later he commissioned the Domesday Book. This was a systematic recording, by districts in England, of all people of property along with their holdings of land, cattle and number of servants. Other details were also gathered. While never intended as an exact population count, nevertheless, it served as a count of those who could bear arms, a list of taxes collected and a reckoning of the assets under the ultimate control of the king.

A. A Nearly Modern Census

In 1665 the government of France took over direct control of the colony of New France, on the banks of the St. Lawrence River. Similar to the British colonies in North America, New France was first created and managed by a company of merchants. They brought traders and settlers to the new land. The New France colony became insolvent under company rule, and the government stepped into the administrative void. The civil servant sent out from France to take over control, known as the Intendent, recognized the first problem: how many people lived in the colony, what was their inventory of skills and what employment were they engaged in? Intendent Jean Talon immediately set out the rules for the census taking.

First he established the de jure principle of counting people where they lived. Second, he prescribed the recording of skills. Last, he had information taken systematically on the houses and farms. Talon’s census was remarkably complete and showed that the colony’s population was widely distributed geographically. For a small colony of only 3215 inhabitants it was serviced by a surprisingly broad array of tradesmen, administrators and church officials. The most surprising fact, however,
was the gender imbalance. The census recorded 2034 males and 1181 females. That is, in 1665 there were two males for every female (the ratio for ten years earlier may have been roughly 6:1). Talon immediately asked the French government to “recruit” marriageable aged young women for the colony. Between 1665 and 1673, 900 filles du roi – named “daughters of the king” because the royal exchequer financed their travel and paid each a dowry – arrived in New France. These were young women without prospects in France; orphans or those without families. Some young widows were included. The gender balance of near equality was quickly achieved and, because it was a young population, it was very fecund. Many filles du roi married soldiers who were then urged to settle in the colony permanently.

A subsequent census in 1671 recorded 700 children born in that year, an incredibly high fertility rate. This surge of births was echoed and re-echoed for the next 100 years.

Arrival of the Filles du Roi

A highly romantic 19th century pre-Raphaelite view of the mid-17th century event.
Source: Brickdale, Eleanor Fortescue (1871–1945), Filles du Roi, Courtesy of the Library and Archives of Canada/Bibliothèque et Archives Canada.

Mémoire de M. Talon adressé à Monseigneur Colbert
Fait à Québec, ce dixième Novembre 1670

“Monseigneur,... Toutes les filles venues cette année sont mariées à 15 près que j’ai fait distribuer dans des familles connues en attendant que les soldats qui les demandent aient formé quelque établissement et acquis de quoi les nourrir. ….. Pour avancer le mariage de ces filles, je leur ai fait donner, ainsi que j’ai accoutumé de faire, outre quelques subsistances, la somme de 50 livres monnaie du Canada en denrées propres à leur ménage.”
Source: Mémoire de M. Talon, 1–118.
B. Modern Censuses

The first national modern census in the US dates to late 18th century. In the new US, the Constitution extended suffrage to the free (male) population, and because representation in the Congress was related to population it was necessary to have an accurate count of voters by region. The 1790 census recorded little extra apart from a few characteristics such as age, place of birth and some rudimentary information about agriculture and industry. Each subsequent US Census was an improvement on the previous census. By 1851 the Census of Manufactures was added in such a way that it was consistent enough for later users to link it to later versions for time series analysis. Outside the US modern (usable) censuses appeared in many countries in the late 18th and 19th century: Denmark in 1769; United Kingdom in 1801; Canada in 1851/1871; New Zealand in 1851; Australia in 1841/1901, India in 1872; Germany in 1895 amongst others.

Census data are usually presented in aggregate form. They are snapshots of a population at a specific moment in time. Since censuses also include information on the households, they are extremely useful evidence (sometimes the only evidence) for vital public policy making. For instance, in the early 20th century censuses were used to track the electrification of households and the presence of indoor sanitation. This gave rise to targeted state or state-directed public investment. These aggregate data are then sub-divided by county or district, town or city. Indeed, there are a great variety of cross-sections that are presented.
The census data in aggregate form are compiled from the “census manuscripts.” These are submitted by the census official known often as the enumerator. Census manuscripts are normally held secret for long lengths of time, typically one hundred years, because they record personal information about living individuals. Many countries are now releasing these documents from the 1901 and 1911 censuses. The task, however, is enormous and politically sensitive. In addition, they are often produced in digitized form, which makes them readily available for micro-historical purposes. Furthermore, databases can be linked to produce longitudinal studies, say tracking a particular family through the generations within a country or as they move from, say, England to Australia or Denmark to the US. Normally, the worksheets of the enumerators were prepared for each household and, by the mid-19th century, are rich in detail. In the US the 1850 Census reported the value of property held by the family (or head of household) and in the 1860 census, both annual income and property. Generally, the census manuscripts varied tremendously in quality of reporting even in one year, and even within a country by where the data were gathered. The reliability of the data is dependent on the qualities of the enumerators. Enumerators were locals recruited for the task and were mostly known to the respondents. The conjecture is that as they moved from farm to farm in the American South, for instance, accepting a friendly glass of corn whisky at many of the stops, their recording skills slipped. Over time, the reliability of the information presented improved and the variation of reporting quality was reduced.

Of course, there are gaps between censuses, typically ten years. Partial censuses in more recent times have often been conducted in the middle of the inter-censal period after five years. They nonetheless provide essential checks of the otherwise estimated population size. They also provide an important residual calculation. If the total number of births and deaths are known and if we also know the number of arrivals from abroad, then the missing element of population change as reported in the census is the number of departures. Emigrants were seldom otherwise recorded. The difficulty with this calculation is that it tells nothing about the timing of their departures. Indeed, many researchers simply average the departures over the inter-censal gap. The history is usually different. Take Canada’s emigration history of the 1880s. The Census show a large population decline over the decade but it is also clear from other evidence that this is accounted for by emigration and that the bulk of individuals who left departed in the last five years of the decade. Filling gaps seem to be one of our important historical tasks.

C. Some Problems of Early Modern Censuses

1. **Quality of enumeration (and enumerators):** often questions were not well-defined or explained adequately to the respondent. The selection of enumerators was often haphazard and they themselves were, on occasion, barely literate and thus did not have the ability to question a patently incorrect response. Census questions and the quality of enumeration improved through time.

2. **Inaccuracies and misreading:** apart from incorrect transcriptions of the information there was ample scope for error.
3. **Coverage and thoroughness**: are determined by the resources devoted to the census gathering enterprise. Since the data are gathered on one particular day and because of noted errors, the ability to go back and find absentees and correct errors is critical to the veracity of the census. Indeed, some censuses were inadequately funded from the outset, forcing short-cuts.

4. **Representation of women** (common to most historical censuses): The major omission has been the recording of female employment, work and income. Since women, historically, were not considered the main source of family income the question was often omitted or no declaration was given. This is undoubtedly due to the fact that women’s incomes were often made in the informal labor market. These included: taking in washing, housekeeping, care of others’ children for pay, piece work in the home and the like.

### 1.10 Models of Human Behavior

The human behavior of demographic change involves human decision-making at its most intimate. Few economists argue that individuals base their decisions on a fine economic calculus – yes, sensible economists do exist. It is helpful, nonetheless, to think of the *opportunity cost* of human actions. Thus, we might consider the price of a child to be the cost of opportunities foregone by having that child (e.g., the income of the mother if she takes uncompensated time away from the labor market, the cost of additional housing space, consumption of goods and services and so on). This raises an important issue, one that we find through history, of how we theorize about human responses to economic stimuli. Malthus laid out the territory. So far as possible we model human behavior with specific causal relationships in mind, state the assumptions from which we start and chart those to a conclusion. This suggests a fine degree of individual awareness and economic calculation. We know, however, that this is not how individual humans usually behave. Yet, when we examine the economic behavior of many individuals on average, or in aggregates, the responses often appear to conform to the theory *as if* individuals made these fine calculations. In practice, of course, there is a huge amount of individual variation. Our modeling of the process represents the tendencies in human decision-making, which turn out to be quite precise although not the exact reasoning of each participant.

Individual decision-making rests on individual preferences (or tastes) which when arranged are known as a “utility function.” However, humans through all of their history have existed as part of families, and it is often families that are the decision-making units. The social dynamics of how these decisions are made varies both from family to family and with time. For instance, women quite frequently occupy the historical role as the main distributor of food within the family. They do not do so evenly: calories seem to be distributed in favor of those with the greater work (caloric) needs. So, family decision-making is not straightforward, as most families would attest. In general, we care about members of our families more intensely than we care about others. The historical evidence suggests that this is a very basic instinct and that it has always been present. In addition, there is nothing preventing individuals having preferences that are social in nature. The individual utility function may have “a taste”
for a certain distribution of income and individuals exercise this taste by, say, voting for a more (or less) progressive tax structure.

In human decision-making we also demonstrate a concern for future generations. There are those who argue that we wish our genes to be passed on and to survive. Because we care about the fate of our children, grandchildren and those who follow, our time horizon is not limited to our natural life span. As a consequence, there are two distinct notions of accounting for time that enter into consideration, one that applies to each individually in a private context and that that applies in a social context with a broader viewpoint. These are:

- the discount rate or marginal rate of time preference; and
- the social rate of discount.

We can think of the discount rate as the return that individuals require in compensation for postponing the receipt of income or consumption today. Banks, for instance, induce private savings (the opposite of consumption) by offering a rate of return on the funds held. The higher the rate of return the greater is the inducement to save. This is the private discount rate. However, if we value something on societal grounds we are, in that valuation, applying a greater social rate of discount. For example, in order not to deplete a fishery too rapidly, a social benefit, we will reduce today’s consumption in order to ensure an on-going stock of fish. That is, we have valued future consumption (preservation of the fish) and that of our children more highly in the future.

The benefits to the individual (and to society) from any deliberate choice may be intrinsic. We call these the “psychic benefits”. If an individual refuses a higher wage offered in a far location in order to remain at home, we have a ready appreciation of how much the individual values their current location, on balance. These intrinsic benefits will vary with each individual or family and indeed may be even be negative. As we see later on when discussing international migration, the vast majority of people do not enter into the flow of migrants. Our theory of migration then is limited; it has little predictive value for the “non-movers.” The psychic benefits (and costs) are the theory receptacles into which we place the social benefits (and costs), which are not directly quantifiable. Because of the inherent social nature of human society these are often large and persistent.

### 1.11 Outline

Population and its growth are at the heart of economic history. Indeed, they are so much part of the story that it is difficult to separate them from those other economic, social and political forces of history. Yet, with perhaps the exception of the most
dedicated positivist, we simply cannot retain indifference to the human dimension. Capital, land, natural resources and labor may be functional inputs into production but most of us cheer for labor because it is the factor about which we all must make decisions. So with complex sets of events with complex historical outcomes, and with our human intuition, what is our analytic approach?

Throughout this history we separate the discussions into several useful economic groupings. Each focuses on the analysis of the population, both as an object and subject, from a different perspective. They are:

- **Aggregate economic performance (macro):** the behavior of the economy-wide aggregates and indicators of performance including economic growth.
- **Individual and family (micro):** the factors that influence the patterns of mortality, fertility and migratory behavior and the personal decision-making that determine these patterns.
- **Medical and epidemiology:** the advances in medical thinking that influence the health of the population, and the progress of disease and its influence.
- **Externalities:** the creation of social benefits and social costs that are not directly enjoyed or paid for by the economic agents engaged in an economic activity, such as production.
- **Catastrophes:** extraordinary (exogenous) events that cause large change in the population, its growth and behavior.
- **Institutional development:** the study of how society adapts to population change in terms of its institutional arrangements and property rights.
- **Education and technical change:** the influences that bear on investment in human capital.

Naturally, these themes overlap one another. Migration is a case in point. It has micro foundations in individual decision-making, is influenced by macro events and has aggregate economic consequences. We begin, however, with the overview of the landscape of population and its macroeconomic history, the subject of the next chapter.

**Endnotes**

1 See Sykes (2001) and Wells (2007) for DNA version of spread. Also see Mann (2006).
2 It had two distinct phases: the cooling phase from about 1400 to 1650 and the cold phase to 1850 with substantial warming in the mid-19th century. There is no common agreement on the early dating because the effect was also local in character. Different locations of measurement from sediment, ice cores and seabeds yield slightly different dates. Most climate historians, however, agree that the Little Ice Age ended in the mid-19th century.
3 Modern forms of these techniques survive in Korean kimchi or Italian air-dried ham, prosciutto.
4 Diamond (1997).
5 This statement is often made of only 20th century conflicts. We include the Taiping Rebellion in mid-19th century China with its direct death toll of over 20 million and the US Civil War. The last phases of the US Civil War, especially the siege of Richmond, was very similar to the trench warfare of the 1914–1918 conflict.
This is the concept of the marginal rate of time preference.

Green et al. (2010).


“DNA” stands for deuto rhybo-nucleaic acid.

Forster (2004), 255–64.

_Homo sapiens_ were once thought to be unique as tool-makers. Evidence now suggests that other humanoids also made tools.

See Manguel (1996) and Mokyr (2002).

Calculated as the compound rate of growth necessary to predict the current observation from the base observation: \( X_n = X_0 (1 + r)^n \) where \( X \) is the population estimate, \( r \) is the rate of growth and \( n \) is the number of years between observations.

Indeed, the mortality shocks for this model have been cunningly calculated to produce exactly this result.


Even if we have complete information on whole populations there are statistical issues surrounding what is meant by comparability. These issues are explored later.

Private goods are those which when consumed are enjoyed by only the individual, e.g., a cup of coffee. A public good is one that is shared by others (they cannot be excluded). These collectively consumed goods include such items as police services. The fact that we cannot exclude others from enjoyment of these collectively consumed goods gives rise to the “free rider” problem, people who consume the good without paying their full share.

Hollander (1997) and Malthus (1798). Cambridge educated, Malthus went on to become Professor of Political Economy at the East India Company College in London.

Any increase in the supply of labor induced by the aggregate growth due to: i) new workers entering the labor market as the lowest wage at which they are willing to work is now met; or ii) net immigration has the potential to lower the real wage.

Despite its insertion into numerous contemporary histories.

These data have been collected by the Center for Population Economics at the University of Chicago under the direction of Prof. Robert W. Fogel (see http://www.cpe.uchicago.edu).

Parish (or the relevant church unit) records are also used for genealogical purposes. In most jurisdictions this function of registration has been taken over by the state. The Church of the Latter Day Saints (Mormons) have collected a huge number of these records world-wide, copied them, distributed them to many centers and make them available to the public on request.


United Nations human statistics include those of: The World Bank, the World Health Organization (WHO), the International Labor Organization (ILO), United Nations Educational, Scientific and Cultural Organization (UNESCO) and others noted in this book.

Their occupations were: three notaries, three schoolmasters, three locksmiths, four bailiffs, five surgeons, five bakers, eight barrel makers, nine millers, 18 merchants, 27 joiners, and 36 carpenters, solders, farmers, fur traders, laborers, administrators, priests and other church officials (Censuses of Canada, 1665 to 1871 [1876]).

Fecundity is the capability of producing offspring in great numbers – see Chapter Three.

Only free individuals were covered although there was a separate enumeration of slaves.

Preston (1987), 619–44. Preston identifies the first three of these categories but adds a fourth, ethical and environmental considerations about the distribution of resources. We think, however, that the ethical dimension is best analyzed in the context of the social rate of discount and externalities and so include it in the categories noted above.
References


