3. Aggregate human fertility rates have historically been lower than the maximum possible rate and higher than the replacement rate.
4. Fertility tends to be inversely correlated with the level of industrialization.
5. Populations alter their reproductive behavior only very slowly in response to changing external conditions.

Some of the basic causal assumptions upon which the population sector is based are simple demographic definitions. Others are widely accepted general statements about human motivations. Still others are postulates, suggested by observers of population behavior; these postulates seem to be consistent with available data but cannot be directly proved or disproved at this time. Each assumption is discussed in more detail when the equation expressing it is presented in the next section (2.5). The basic assumptions may be summarized as follows:

1. The number of births each year is a function of the number of women of reproductive age in the population and the average probability of each woman giving birth that year (the average fertility).
2. The number of deaths each year is a function of the total number of people in the population and the probability of each person dying that year (the average mortality).
3. Average fertility depends on involuntary factors (maximum total fertility, or fecundity), voluntary factors (desire for a given average number of children), and the means available for achieving the voluntary goal (fertility control effectiveness).
4. Maximum total fertility (fecundity) is limited by the same factors that limit the general health of a population, especially the availability of health services and food.
5. Average desired family size is determined in part by the prevailing social norms with regard to families and in part by the average individual's response to those norms.
6. Any society's family size norm depends upon a complex of cultural and environmental factors that influence the perceived social and economic advantages and disadvantages of childbearing. Since any change in this norm must be endorsed by the society as a whole, the social norm shifts gradually, rather than quickly, as the environment changes.
7. Individuals and families do conform to the norm expected of them by society, but only to the extent permitted by their own perceptions and expectations of their personal resources for bringing up children. These expectations may shift relatively quickly.
8. Under conditions of a high perceived child mortality, families will produce extra children beyond the number ultimately desired to compensate for the risk of losing children.
9. Effective, low-cost methods of fertility control will be developed by a society if there is a perceived need for such methods and if sufficient economic resources are available to invest in developing them. In every society—even the most primitive—effective, but high-cost, fertility control methods are already available.

10. The average mortality of a population is also a function of involuntary factors, voluntary goals, and the means to attain those goals.
11. A goal of every human society is to keep its own mortality as low as possible. Therefore, there is always a recognized need for mortality control.
12. The primary mortality control methods are public health and medical technologies and improved means of food production and distribution. All these methods also require the investment of scarce resources from the economic system.
13. Possible factors influencing involuntary mortality are pollution, crowding, and lack of food.

The complex of feedback loops that joins all these assumptions is shown in Figure 2-17. This figure is derived from the classification scheme of Figure 2-16, but it includes, in addition to environmental influences on the population, the return influences of the population on the environment. Each single arrow in the diagram stands for one causal relationship, the direction of the arrow indicating the direction of causation. The arrows imply nothing about the quantitative nature of the relationship; they only indicate that some causal influence is acting there. The influence may be strong or weak, delayed or immediate, linear or nonlinear. The small + or − sign at the arrowhead indicates whether we believe the influence is positive or negative. The heavy arrows indicate inputs from other sectors of the world model. They are explained fully in the following chapters.

The two interlocking feedback loops, one positive and one negative, at the center of the population sector express the demographic relationships common to all population systems. They are shown separately in Figure 2-18. (In this and the

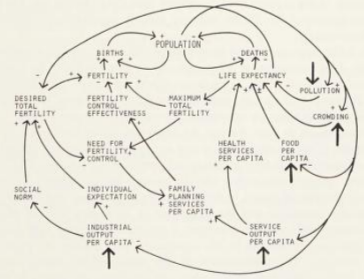

Figure 2-17 Population sector feedback loops