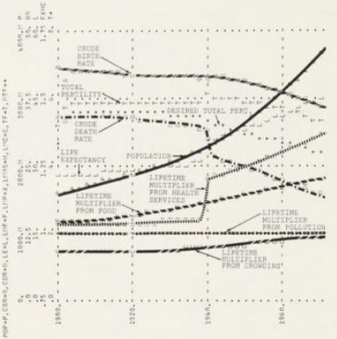

Figure 7-2 Run 7-1: population sector behavior, 1900–1970

Population POP increases over time at an average growth rate of 1.2 percent per year. Both the birth rate CBR and the death rate CDR decrease over the period, the former largely because of a lower desired total fertility DTF, and the latter primarily as a result of increased health services LMHS. Both trends occur as a result of industrialization.

the lifetime multiplier from crowding LMC. It can be seen in Run 7-1 that the increase in LMHS from 1940 to 1970 is greater than the combined changes in the other three lifetime multipliers, although LMF also has a significant positive influence.

An important determinant of the birth rate CBR in the model is the total fertility TF, or total number of children borne per woman. In Run 7-1 the slight decrease in TF from 1900 to 1970 is primarily due to the decline in desired total fertility DTF. The main cause of the decrease in DTF over this period is the increasing industrial output per capita IOPC, for it is hypothesized that the desired family size decreases as industrialization changes social norms about families and childbearing.

In the model, the relationship between desired total fertility DTF and industrial output per capita IOPC is one example of the delayed response of population behavior to external influences. The rise in IOPC affects DTF only after a delay of 20 years, representing the time a society takes to adjust its norms regarding family size. Similar delaying effects attributable to the population age structure are not directly evident from Run 7-1, for the relatively small changes in birth and death rates from 1900 to 1970 do not alter the age structure significantly. A detailed description of the age structure equations and their effects on the model's behavior is given in Chapter 2.

The final time trend evident in Run 7-1 is the shift of birth and death rates that is characteristic of the demographic transition. As the economy of a population undergoes industrialization, the behavior of the birth and death rates of that population usually follows four successive stages:

1. High birth and death rates, slow rate of population growth.
2. Rapidly declining death rate, slowly declining birth rate, increasing rate of population growth.
3. Slowly declining death rate, rapidly declining birth rate, decreasing rate of population growth.
4. Low birth and death rates, slow to moderate rate of population growth.

In Run 7-1 the population POP advances through roughly the first two stages of the demographic transition. The crude birth rate CBR and the crude death rate CDR are at relatively high values in 1900, and the low value of industrial output per capita IOPC indicates that the world system is only in the beginning stages of industrialization. As industrialization proceeds, however, the model moves into the second stage of the demographic transition; around 1940, CDR declines fairly rapidly and CBR declines more slowly. Consequently, the rate of population growth increases in the model during the next thirty years, as happened in the real world. The pattern of development evidenced by the model after 1970 will determine whether or not the model's population proceeds through the final two stages of the demographic transition.

Capital Sector Variables The following list briefly summarizes the historical time trends characteristic of the world economy (see Chapter 3 for a detailed description of these trends):

1. Exponential growth in total capital and in per capita service and industrial output.
2. Shifts in the composition of total output as the level of development (measured by industrial output per capita) increases, as follows:
   a. A decrease in the fraction of total output in agriculture.
   b. A slight increase in the fraction of total output in services (which should remain near 50 percent of total output).
   c. An increase in the fraction of total output in industry.

Run 7-2 (Figure 7-3) illustrates the behavior of the major variables in the capital sector during the 1900–1970 period. Both industrial capital IC and industrial output IO exhibit exponential growth. Industrial output IO grows at an average rate of 3.6 percent per year, which is the same as the historical growth rate of real-world industrial output. Because this rate of growth is greater than the rate of population growth in the model (1.2 percent per year), industrial output per capita IOPC also grows exponentially at a rate of 2.4 percent per year in the model, passing through its 1970 value of 220 dollars per person-year. The growth in IOPC causes increased