Figure 7-3 Run 7-2: capital sector behavior, 1900–1970
Industrial capital IC grows exponentially, causing industrial output IO to grow. Since their growth rate is greater than that of population, industrial output per capita IOPC also grows over the period, as do service output per capita SOPC and food per capita (not graphed). As development proceeds, (1) the fraction of output in agriculture FOA declines, (2) FOA is largely replaced by the increasing fraction of output in industry FOI, and (3) the fraction of output in services FOS remains relatively constant, near 50 percent of total output.

investment and thus growth in both the service and the agriculture sectors. Run 7-2 shows that the growth in service output per capita SOPC is proportionate to industrial output per capita in the model, reaching almost 300 dollars per person-year in 1970. This value of SOPC is slightly below that indicated by world development patterns (330 dollars per person-year) because of the slight delay involved in effecting an increase in service output. The behavior of industrial output per capita IOPC is also a prime determinant of the behavior of food per capita FPC, which is shown later as a part of the behavior of the agriculture sector in Run 7-3 (Figure 7-4).

As the world economy grows, the composition of total world output should change significantly in accordance with the historical development patterns outlined by Chenery and Taylor (1968). The nature of these development patterns are discussed in section 3.2 of Chapter 3. Briefly, a developing economy tends to replace agricultural output with industrial output as the development process proceeds. To illustrate the model-generated development patterns more clearly, Run 7-2 shows the

behavior of the fraction of total output in agriculture FOA, the fraction of total output in services FOS, and the fraction of total output in industry FOI over time. These fractions were approximated by attributing a dollar value to food per capita FPC. The conversion factor for food output of 0.22 dollars per vegetable-equivalent kilogram was obtained by dividing the 1968 dollar value of food per capita (110 dollars per person-year from Chapter 3) by the 1968 value of food per capita in vegetable-equivalent kilograms (500 vegetable-equivalent kilograms per person-year from Chapter 4). Run 7-2 shows that the model-generated and historical development patterns are very similar: as development proceeds, the decrease in FOA is largely offset by the increase in FOI between 1900 and 1970. As a result, the fraction of total output in services FOS increases very slightly, from 45 percent to 48 percent of total output.

In the model, investment is divided between agricultural, service, and industrial capital according to the difference between desired and actual output in each sector. The desired output per capita in each sector changes as development proceeds, reflecting a form of social value change that is built into the model's structure. We chose to include the historical pattern of social value changes reflected in the development pattern described by Chenery and Taylor (1968): as development proceeds, individuals satisfy their food and service needs first, then shift their preferences to industrial output as their incomes rise (see Chapter 3 for a full description of this mechanism). The effects of possible future divergences from this historical pattern of changing values are tested in section 7.6 of this chapter.

Agriculture Sector Variables   The historical time trends of the agriculture sector may be summarized from Chapter 4 as an exponential increase in total food output and food per capita over time, due to:

1. Increases in the cultivated land area.
2. Increases in the average land yield. Land yield increases have resulted primarily from increases in the use of modern agricultural inputs such as fertilizers, pesticides, new seeds, and farm machinery.

Run 7-3 (Figure 7-4) shows the behavior of the World3 agriculture sector between 1900 and 1970, when both total food F and food per capita FPC grow exponentially. Total food F grows at an average of 1.8 percent per year in the model during the 70-year period, and at about 2.4 percent per year during the last 20 years. Food per capita FPC grows at an average rate of about 0.6 percent per year in the model from 1900 to 1970 and at about 0.8 percent per year from 1950 to 1970. The historical growth rates, derived from Figure 4-1, are 2.9 percent per year for total food production and 0.8 percent per year for food per capita FPC for the 1950–1970 period.

The increase in total food production F results from the rise in both arable land AL cultivated and land yield LY. Arable land AL increases in the model from 0.9 billion hectares in 1900 to 1.4 billion hectares in 1970. These values correspond well with the historical values referenced in Chapter 4. Land yield LY increases at an average rate of about 1.5 percent per year over the 70-year period.