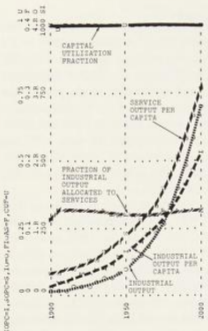

Figure 3-37 Run 3-1: standard run of the capital sector with exogenous inputs

Sensitivity Tests of the Capital Sector

The cardinal determinant of behavior in the capital sector is the rate of growth engendered in the feedback loop linking industrial capital IC, industrial output IO, and the industrial capital investment rate. The change in industrial capital over time may be expressed with the following differential equation:

$$\frac{d(IC)}{dt} = \frac{(IC)(1-FCAOR)(CUF)}{ICOR}(FIOAI) - \frac{IC}{ALIC}.$$

The annual growth rate in industrial capital is

$$G = \frac{d(IC)/dt}{IC}$$

$$= \frac{(1-FCAOR)(CUF)}{ICOR}(1-FIOAS-FIOAS-FIOAA-FIOAC) - \frac{1}{ALIC},$$

where

ALIC	=	average life of industrial capital (years)
FCAOR	=	fraction of capital allocated to obtaining resources
FIOAA	=	fraction of industrial output allocated to agriculture
FIOAC	=	fraction of industrial output allocated to consumption
FIOAI	=	fraction of industrial output allocated to industry
FIOAS	=	fraction of industrial output allocated to services
G	=	annual growth rate of industrial capital
IC	=	industrial capital (dollars)
ICOR	=	industrial capital–output ratio (years)

In the standard run of the capital sector we defined FIOAA = 0.1, ALIC = 14.0, FIOAC = 0.43, ICOR = 3.0, and FCAOR = 0.05 and found FIOAS = 0.12 and CUF = 1.0. Thus the gain around the capital loop is about 0.04, and the doubling time of industrial output is about 18 years. Since population is also growing, but at a slower rate, the doubling time for industrial output per capita is about 30 years. Any change in the model that influences the value of FCAOR, ICOR, FIOAS, FIOAA, FIOAC, ALIC, or CUF will alter the growth rate G of industrial capital IC. If the value of G as defined here is greater than 0, IC will grow exponentially; if G = 0, IC will be constant over time, with the industrial output allocated to industrial investment (FIOAI × IO) only replacing depreciation. If G < 0, the amount of capital stock will decline exponentially toward zero over time. Runs 3-2 (Figure 3-38) and 3-3 (Figure 3-39) illustrate the behavior of the capital sector for different values of G greater than 1.0. To obtain Run 3-2 we changed the average lifetime of industrial capital ALIC from 14 to 21 years. The result is a substantial increase in the growth rate of the sector. Instead of reaching 250 dollars per person-year by 1970, IOPC now reaches 900 dollars per person-year by 1970. Run 3-3 illustrates the capital sector's behavior when we assumed an industrial capital-output ratio ICOR of 2 years. When less capital is required to produce the same output, capital growth can proceed much more quickly than in the standard capital sector run (Run 3-1). When ICOR is reduced by one-third, all else being equal, IOPC rises to 250 dollars per person-year by 1922 and is substantially beyond the scale limit of 1000 dollars per person-year by 1970. Run 3-4 (Figure 3-40) portrays the results when ICOR was set equal to 4 years, an increase of 33 percent from the standard

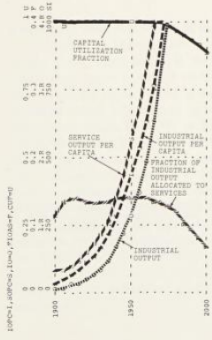

Figure 3-38 Run 3-2: behavior of the capital sector when the average lifetime of industrial capital is increased from 14 to 21 years with standard inputs