

Figure 2-29 Famines and mortality in medieval France

Source: Adapted from Figure 10 of the *General Theory of Population*, by Alfred Sauvy, translated from the French by Christophe Campos, © 1969 by George Weidenfeld and Nicolson Ltd., and © 1966 by Presses Universitaires de France, Basic Books Inc., Publishers, New York.

lagged behind maximum times of food shortage by only a few months (Keys et al. 1950, pp. 19–29). In the reverse direction, an increase of food in a population that has been suffering from malnutrition can have a measurable effect on the death rate within a year—a period of time negligible in the 200-year perspective of our model runs. Thus we did not include an explicit delay between food per capita FPC and life expectancy LE in World3.

Lifetime Multiplier from Health Services LMHS Although the correlation between available health services and life expectancy is generally recognized, there is surprisingly little concrete evidence with which to quantify it. The history of rising life expectancies around the globe, especially during the past forty years, is impressive (see Figure 2-6). Concurrent with this unprecedented improvement in human health has been a worldwide increase in medical knowledge and in public health efforts by local, regional, national, and international organizations. To link these two phenomena quantitatively, we must be able to answer the following questions:

1. Given a certain level of resources (capital, manpower, and manufactured goods) allocated to services in the economy, what fraction of these resources is likely to be devoted to health services?
2. Given a certain expenditure on health services per capita, what actual life expectancy would be experienced by a typical population, all other factors held constant?
3. Is the response of life expectancy to health service expenditures immediate or delayed?

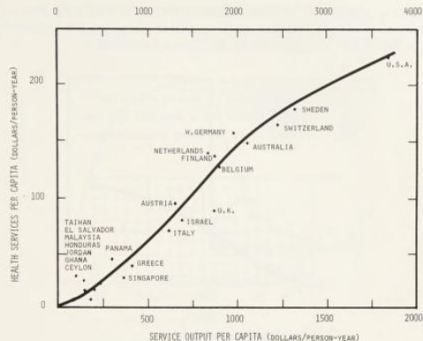


Figure 2-30 Health expenditures per capita versus service output per capita
Source: WHO 1971.

Information on total per capita health expenditures for the nations of the world has only recently been requested by the World Health Organization, and few countries have so far released any pertinent statistical data. In its 1971 summary of the world health situation, WHO published both private and public health expenditures for twenty-five countries. These are the most complete figures we were able to find for national health expenditures, and WHO qualifies them heavily. In some cases, only central government figures were recorded, but most of the nations do include central, state, and local expenditures in their estimates. Difficulties arise in comparing values of local currencies and in evaluating the quality and distribution of the services bought. Better statistics will probably be available in the future, since WHO realizes the importance of these data: "Despite the complexity, . . . this line of research is of growing importance in national health planning, and more knowledge is needed on the subject of health costs" (WHO 1971, p. 53).

In Figure 2-30, total health expenditures per capita (public and private) for these twenty-five nations are plotted as a function of total service output per capita. The relationship is slightly S-shaped and quite regular. The solid curve in Figure 2-30, which approximates the general trend, is included in the model to represent the increase in health services allocations per capita HSAPC as a function of total service output per capita SOPC. Thus in the world model, health services allocations per