

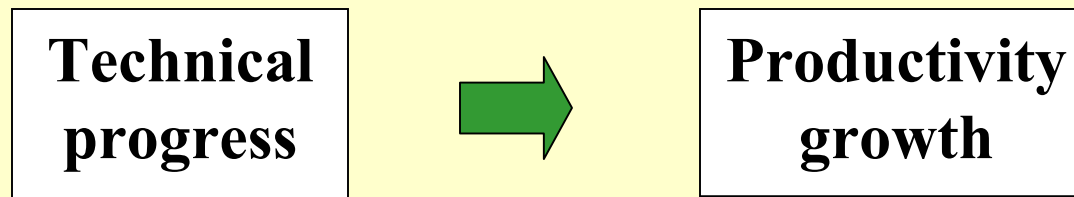
Biomedical innovation and productivity growth

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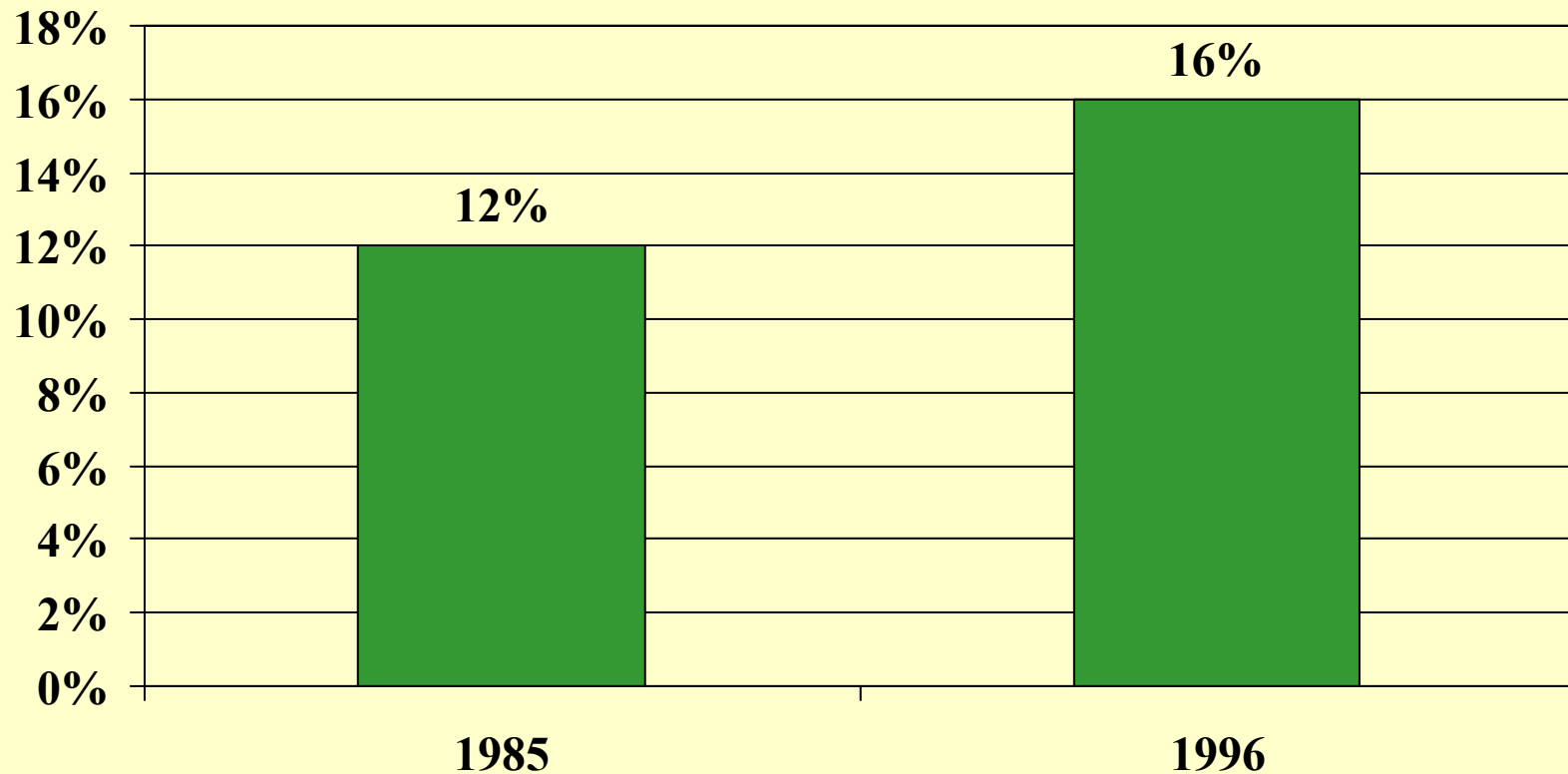


Solow (1956): technical progress is necessary for there to be sustained productivity growth

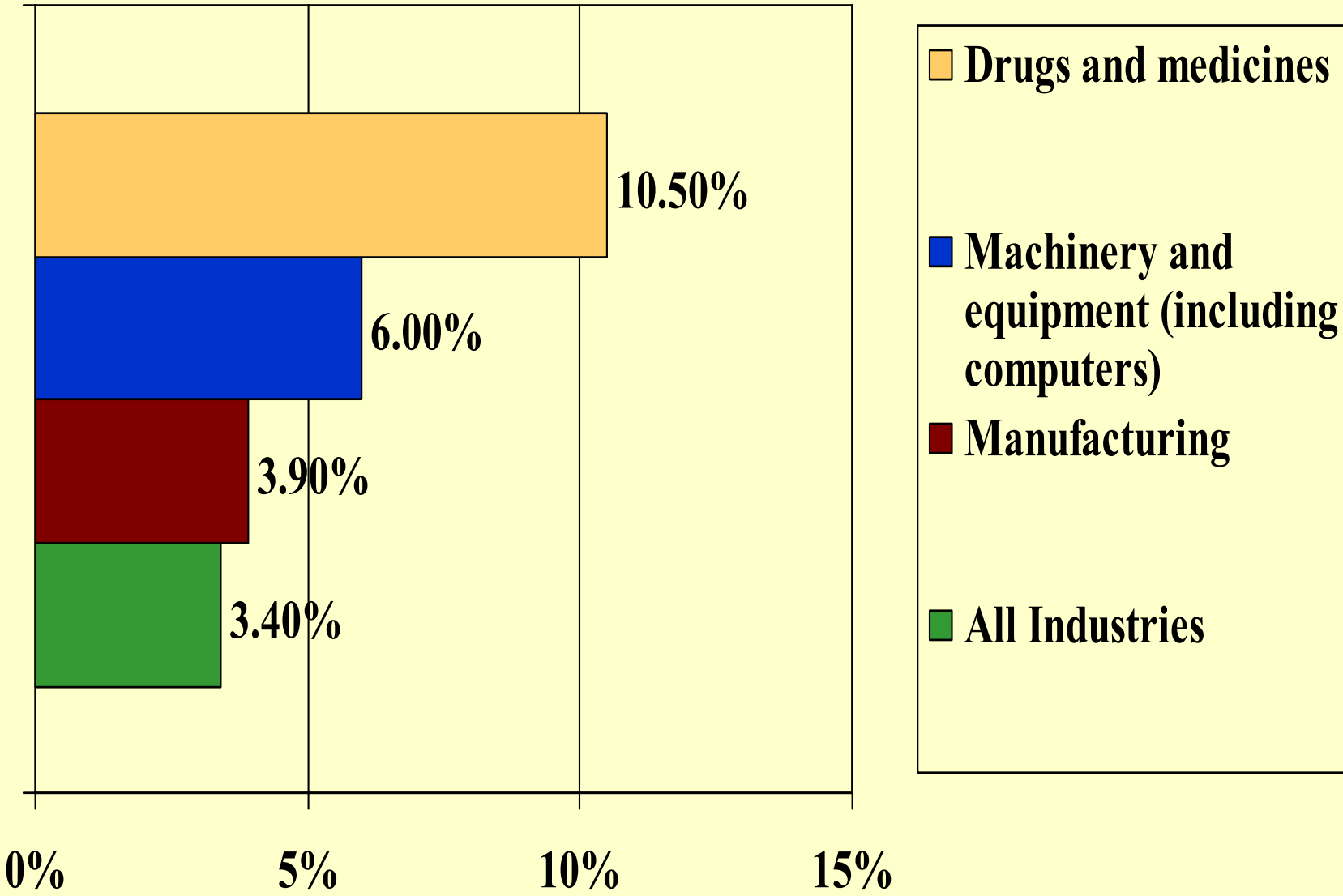
Endogenous growth models:



% of U.S. R&D primarily associated with the life sciences

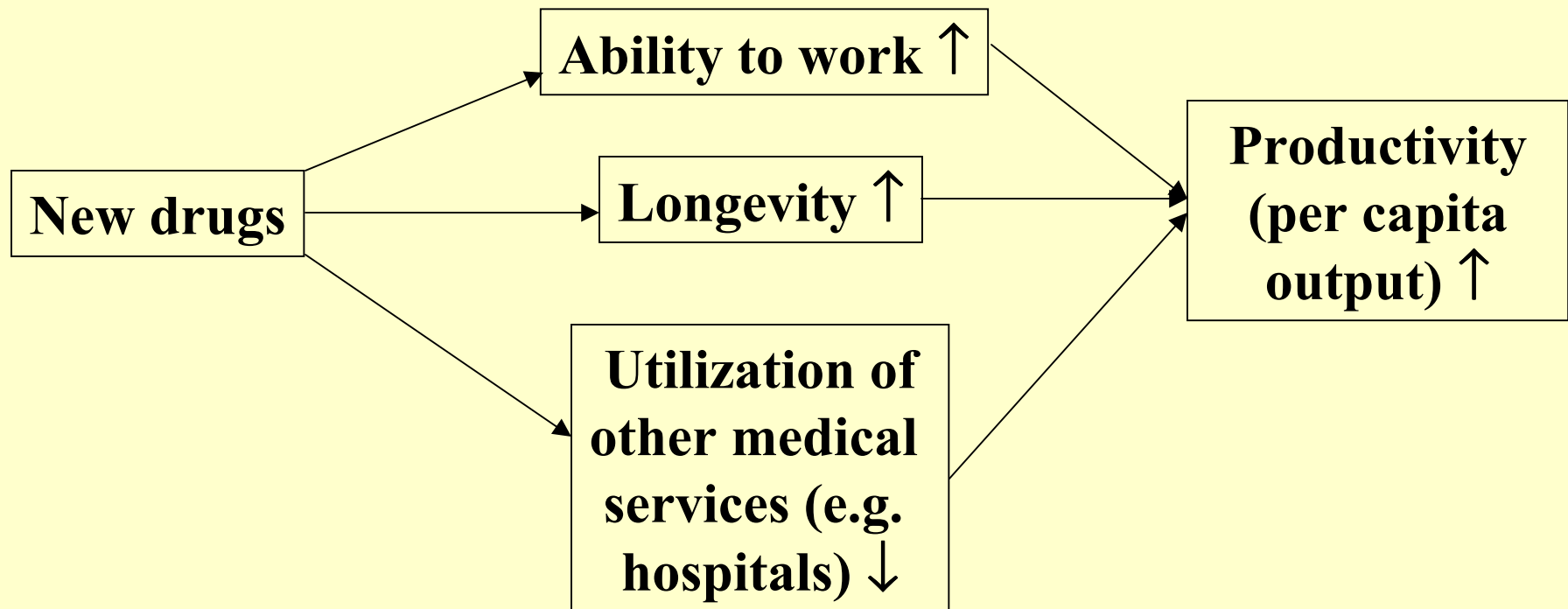


Industrial R&D funds as a percent of net sales in R&D-performing companies, 1997

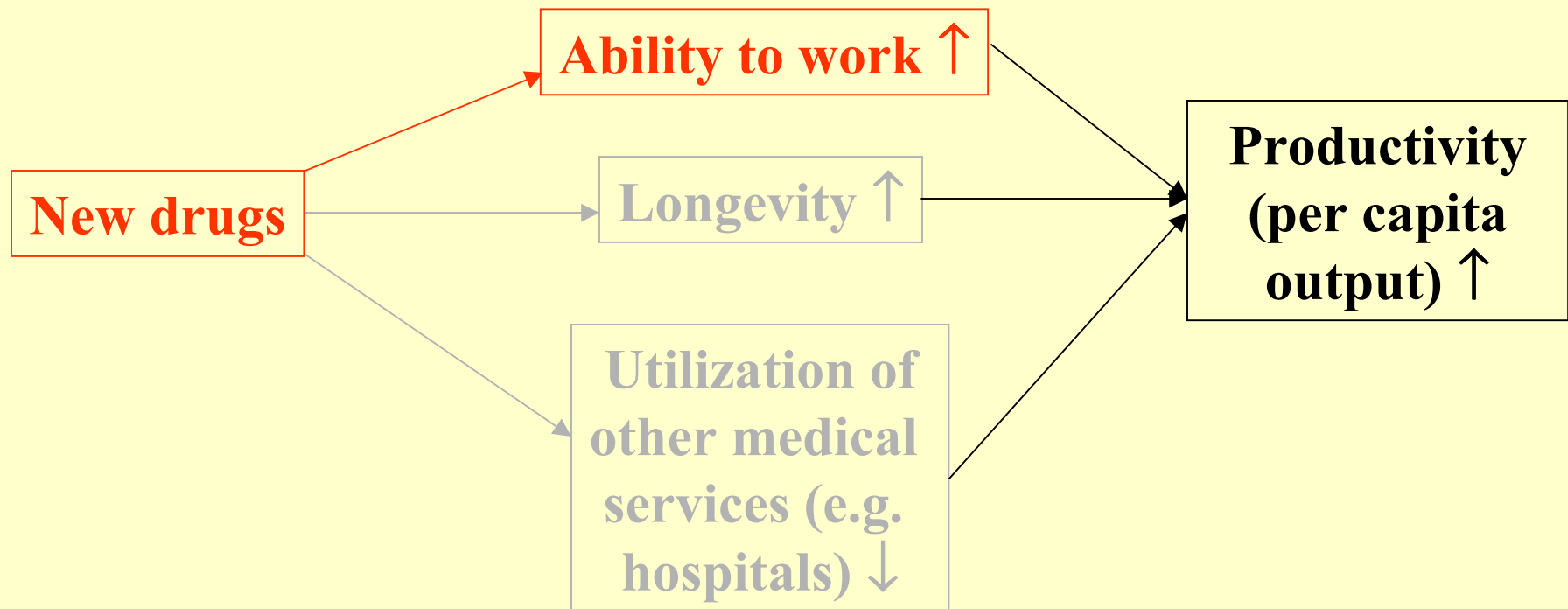


New drugs increase productivity in three ways

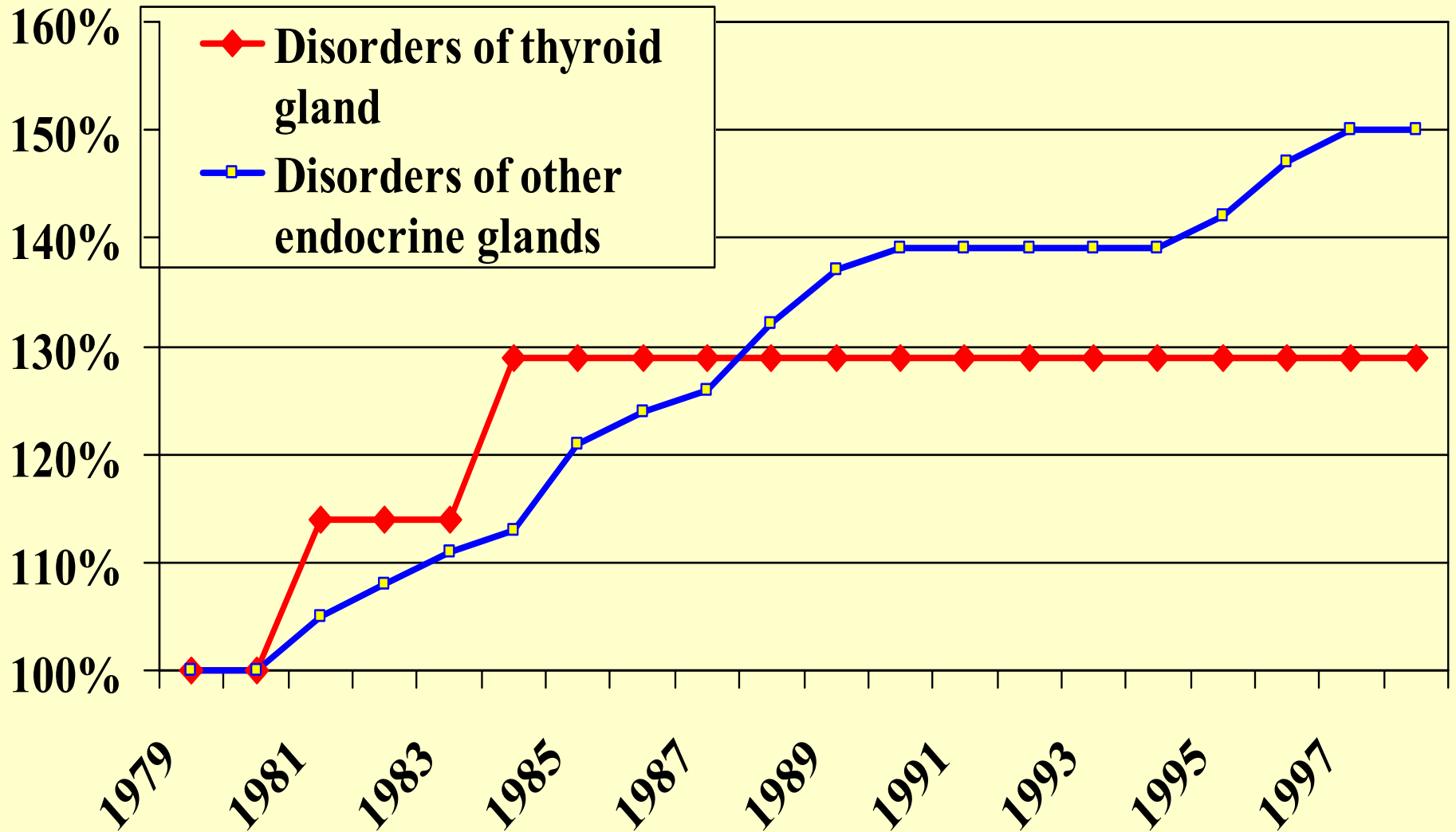
(both outside and inside the health care sector)



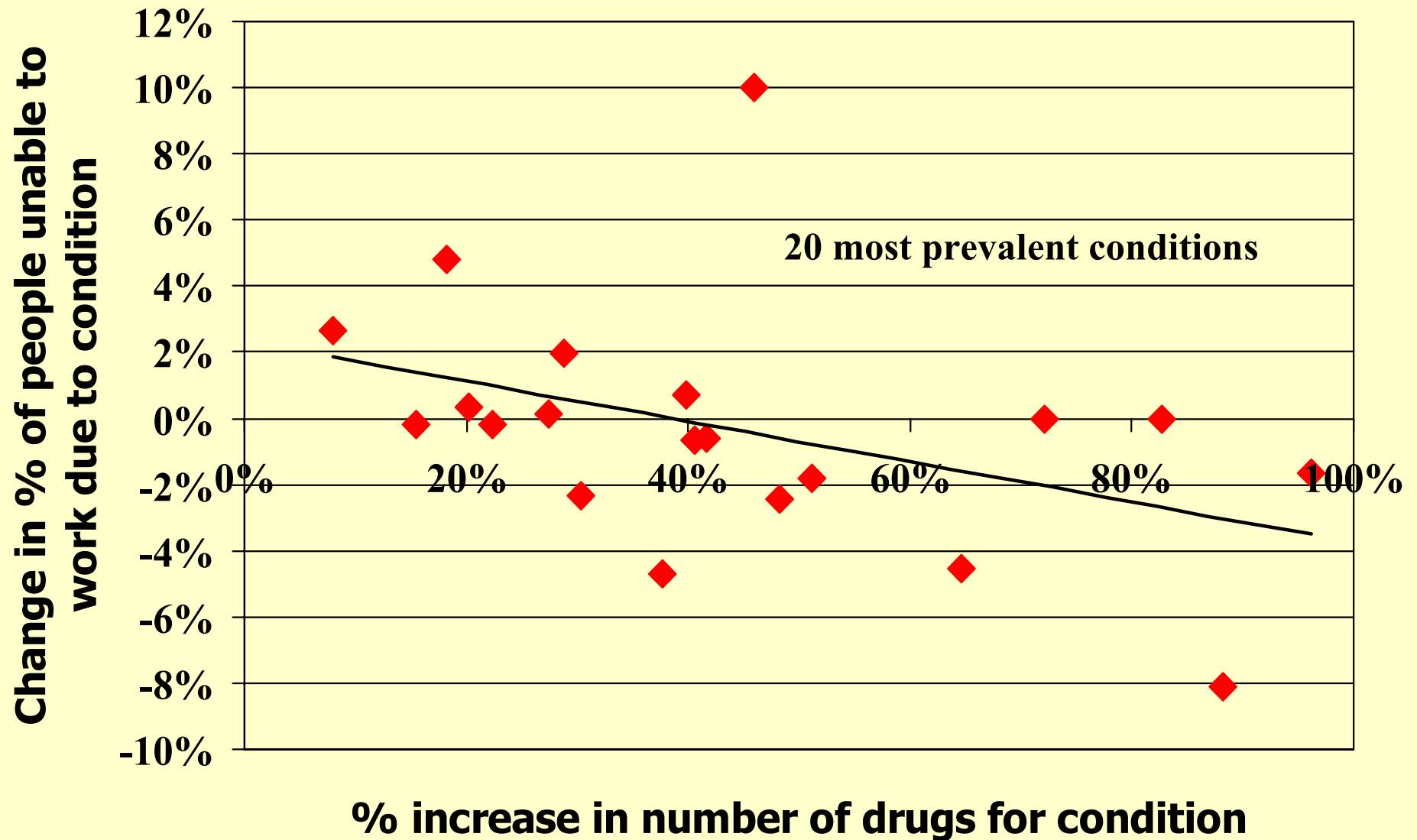
New drugs increase productivity in three ways



Rate of pharmaceutical innovation varies across medical conditions



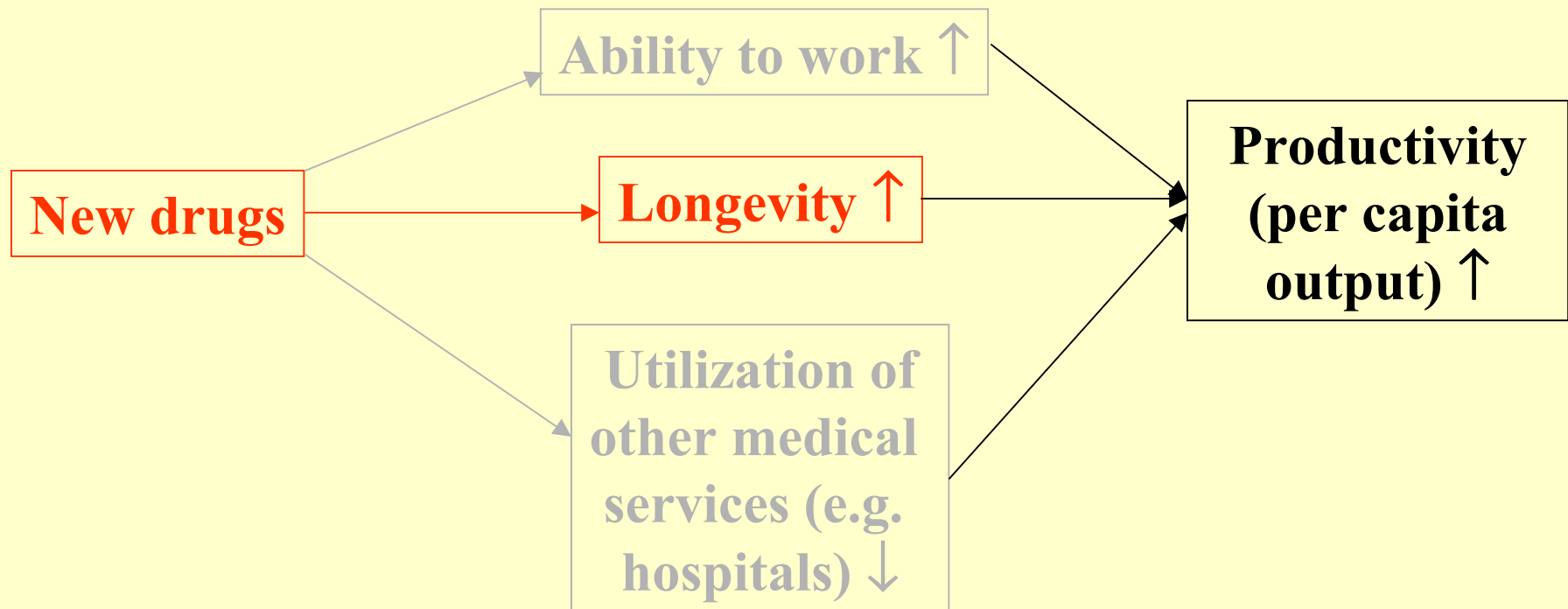
Inability to work declined most for conditions with largest increase in number of drugs available



Estimated effects of 1983-96 new drug approvals

- reduction in number of people unable to work:
1.44 million
- value of reduction in number of people unable to
work (@ \$30K/year): \$43.3 billion/year
- reduction in work loss days per year of currently
employed persons: 98.8 million/year
- value of reduction in work loss days (@
\$100/day): \$9.9 billion/year
- reduction in restricted activity days of all persons:
423 million/year
- reduction in bed days of all persons: 178
million/year

New drugs increase productivity in three ways



Economic importance of longevity increase

- Utility, or welfare, depends on (leisure) *time* as well as goods
- Increase in longevity (from about 50 years in 1900 to 78 years in 1997) has been the major source of increased leisure time over the life cycle
- Nordhaus: “to a first approximation, the economic value of increases in longevity over the twentieth century is about as large as the value of measured growth in non-health goods and services”

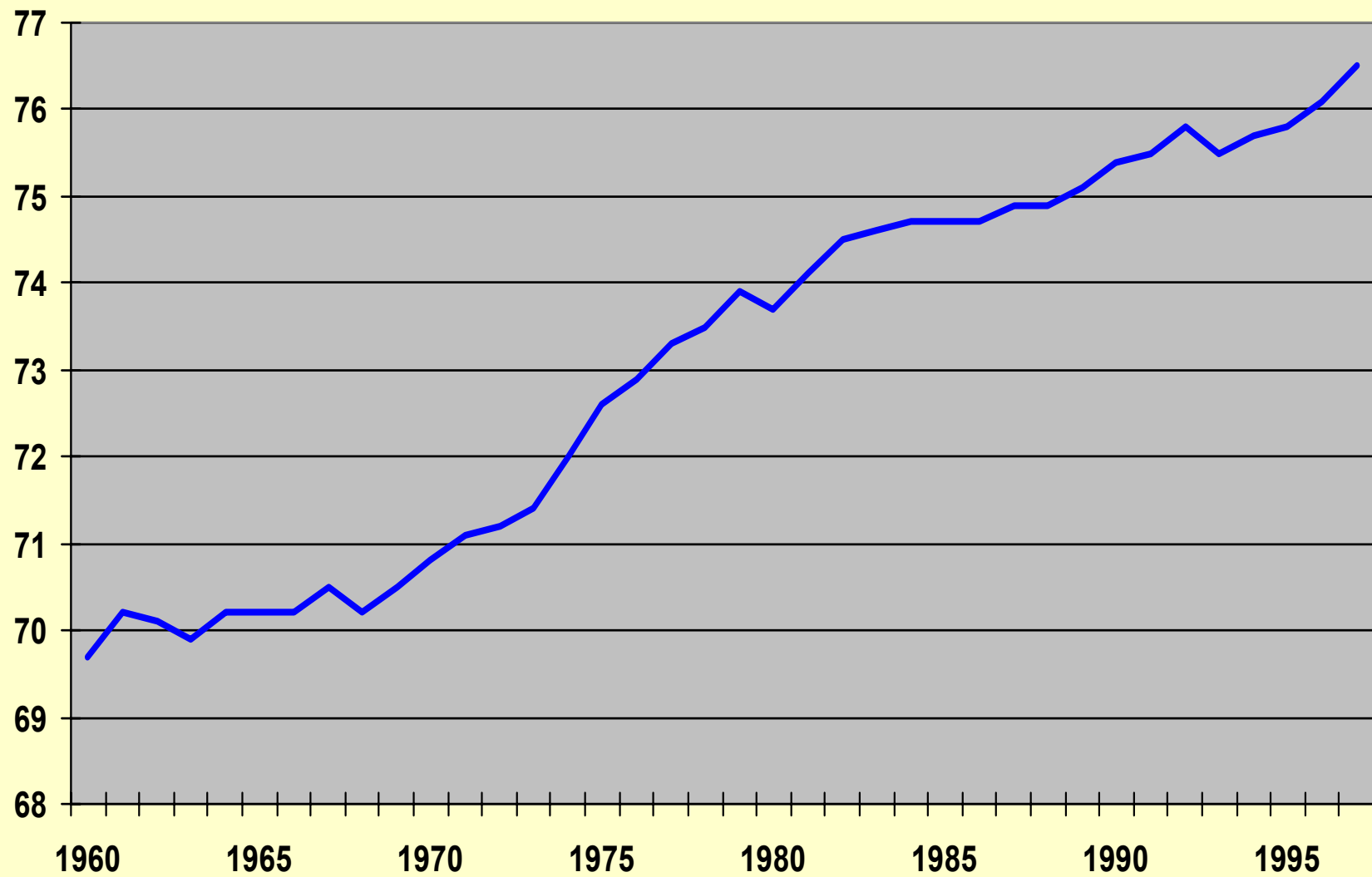
Contribution of new drugs to longevity increase

- Longevity (mean age at death) increased by 3.8 years from 1979 to 1998
- The increase in mean age at death varied considerably across diseases
- *Mean age at death increased fastest for diseases with the largest increase in the number of available drugs*

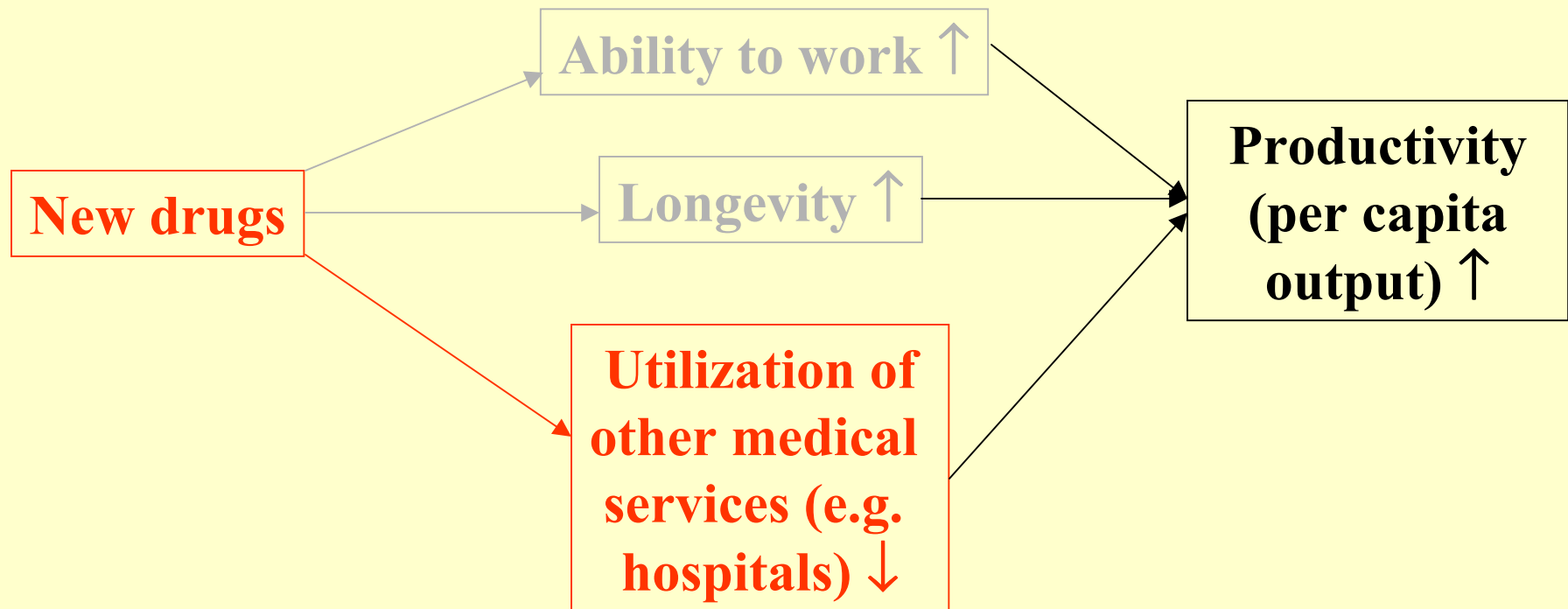
Contribution of new drugs to longevity increase

- I estimate that the increase in the stock of drugs increased mean age at death by at least 0.39 years (4.7 months) during this period
- According to Murphy and Topel, average willingness to pay to live an additional year is approximately \$150,000
- Hence the per capita value of the 20-year increase in longevity attributable to new drugs is \$58,500.

Life expectancy at birth, 1960-1997



New drugs increase productivity in three ways



New drugs reduce other medical costs

- Although new drugs are more expensive than old drugs, *people who use newer drugs tend to use fewer non-drug medical services (hospital stays, MD visits, home health care) than people who use old drugs* (Example: Gleevec)
- The reduction in non-drug medical costs exceeds the increase in drug costs by a substantial margin (4:1 or more)
- Consistent with Grossman & Helpman (1991): “Innovative goods are better than older products simply because they provide more ‘product services’ in relation to their cost of production”

Summary

- R&D is the fundamental source of productivity growth
- Pharmaceuticals/biotech is the most R&D intensive sector of the economy
- New drugs have increased productivity in three ways:
 - increased ability to work
 - increased longevity
 - reduced utilization of other medical inputs