



Information Technology and the G7 Economies

By

Dale W. Jorgenson

Harvard University

March 22, 2004

Economic Growth in the Information Age

INTRODUCTION:

Prices of Information Technology

THE INFORMATION AGE:

Faster, Better, Cheaper!

ROLE OF INFORMATION TECHNOLOGY:

IT Prices and the Cost of Capital

AMERICAN GROWTH RESURGENCE:

IT Investment and Productivity Growth

ECONOMICS ON INTERNET TIME:

The New Research Agenda

THE INFORMATION AGE: Faster, Better, Cheaper!

MOORE (1998): "If the automobile industry advanced as rapidly as the semiconductor industry, a Rolls Royce would get half a million miles per gallon, and it would be cheaper to throw it away than to park it."

INVENTION OF THE TRANSISTOR:

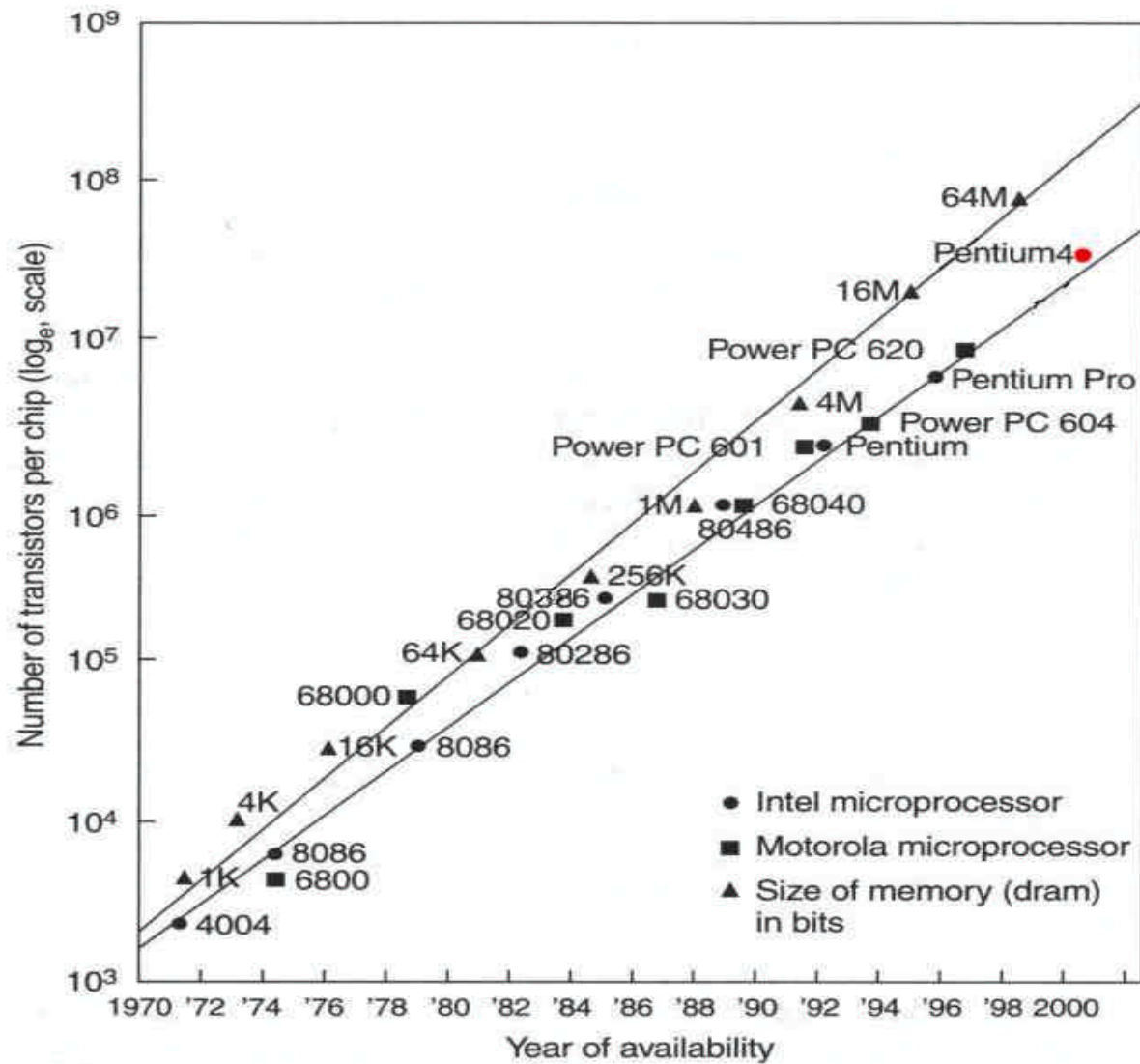
Development of Semiconductor Technology.

THE INTEGRATED CIRCUIT:

Memory Chips; Logic Chips.

MOORE'S LAW: The number of transistors on a chip doubles every 18-24 months (Pentium 4, released November 20, 2000, has 42 million transistors).

Transistor Density on Micro Processors and Memory Chips



HOLDING QUALITY CONSTANT Matched Models and Hedonics

SEMICONDUCTOR PRICE INDEXES:

Memory and Logic Chips.

COMPUTER PRICE INDEXES:

The BEA-IBM Collaboration.

COMMUNICATIONS EQUIPMENT:

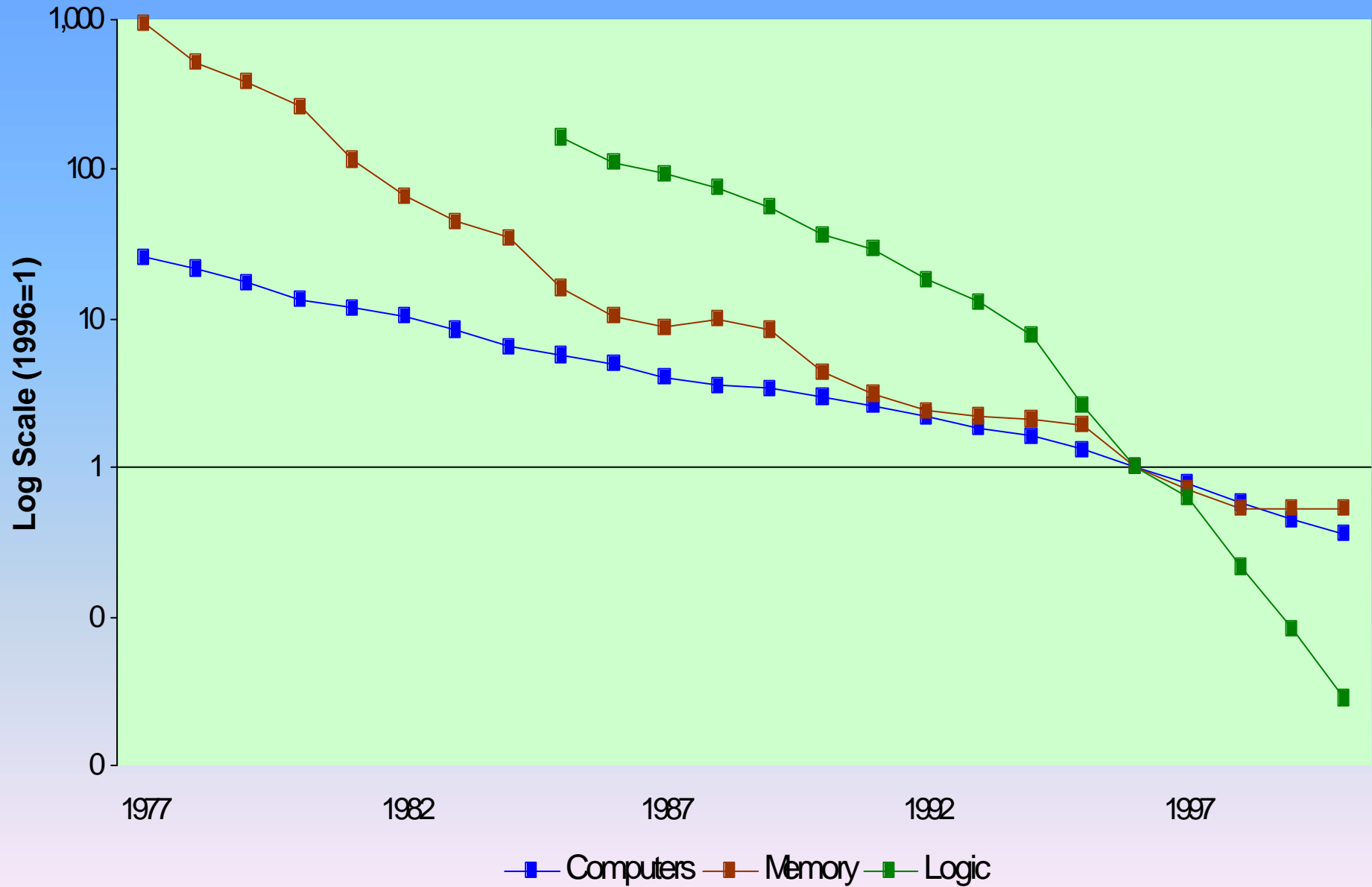
Terminal, Switching, and Transmission.

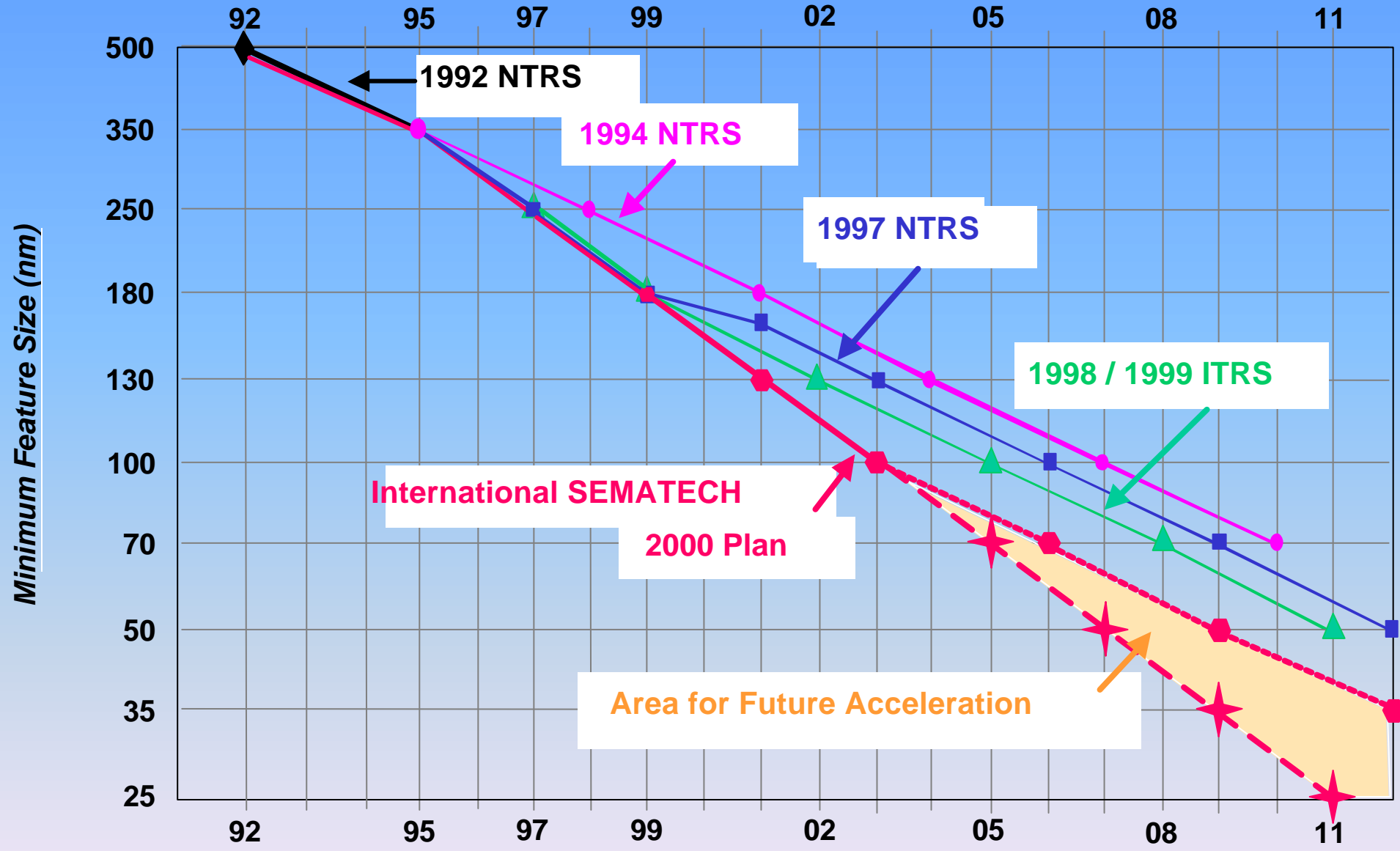
SOFTWARE:

Prepackaged, Custom, and Own-Account.

Relative Prices of Computers and Semiconductors, 1977-2000

All price indexes are divided by the output price index.

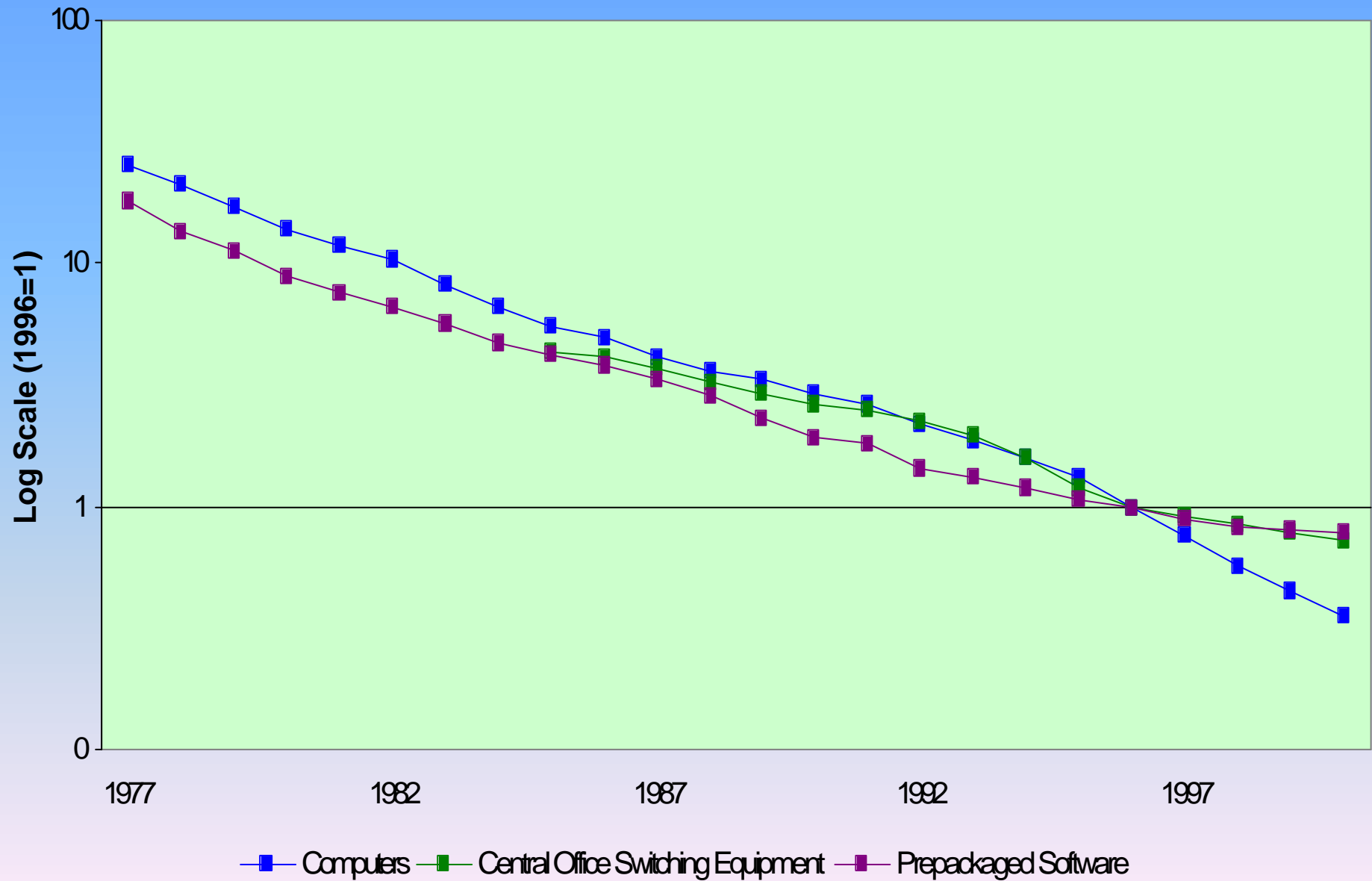




Semiconductor Roadmap Acceleration

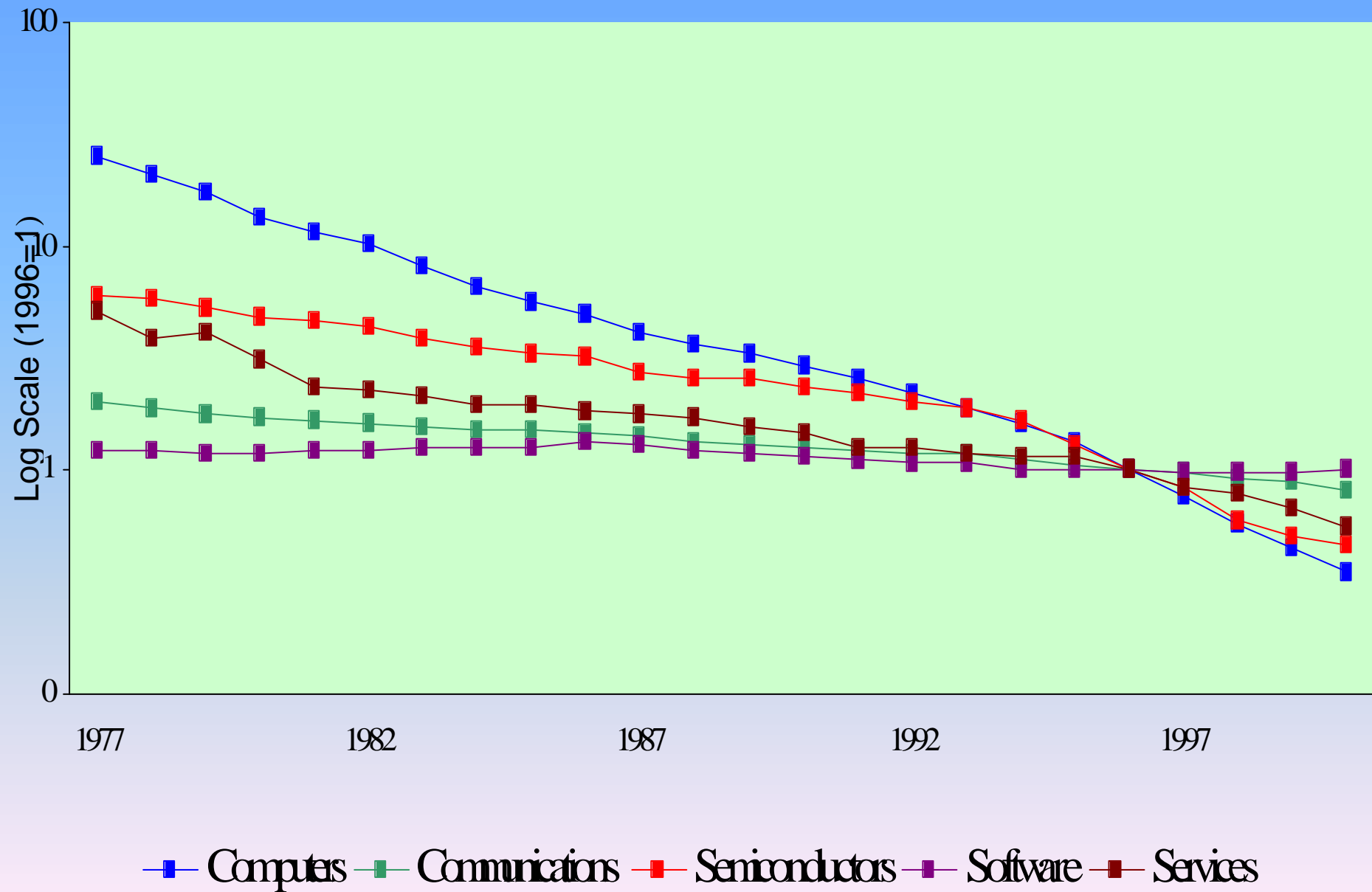
Relative Prices of Computers, Communications, and Software, 1977-2000

All price indexes are divided by the output price index.



Relative Prices of Computers, Communications, Software, and Services, 1977-2000

All price indexes are divided by the output price index.



ROLE OF INFORMATION TECHNOLOGY: IT Prices and the Growth of Output.

OUTPUT SHARES OF IT:

Computers, Communications Equipment, Semiconductors, Software, and IT Services.

OUTPUT CONTRIBUTION OF IT:

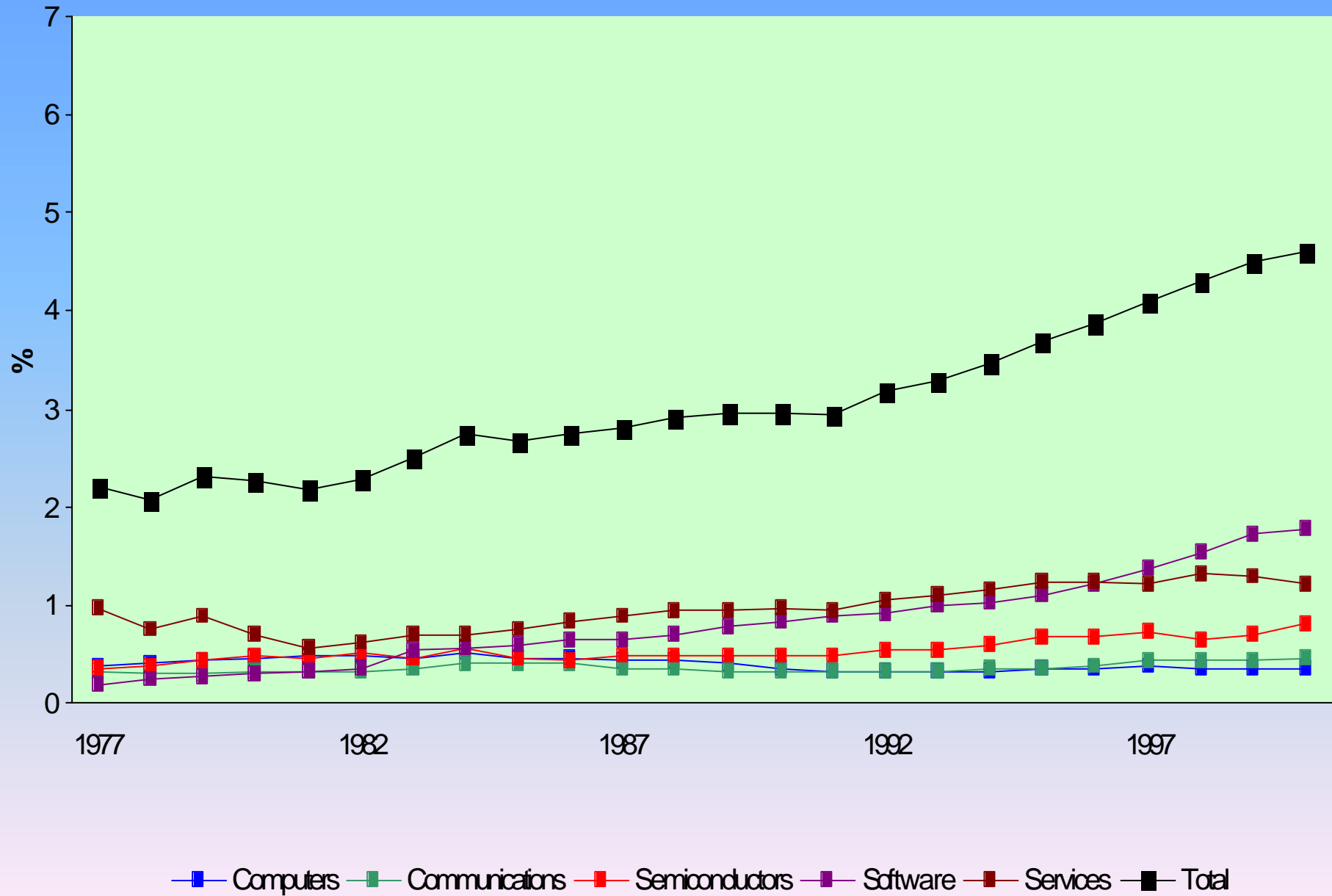
IT versus Non-IT Value Added.

OUTPUT CONTRIBUTION BY TYPE:

Computers, Communications Equipment, Semiconductors, Software, and IT Services.

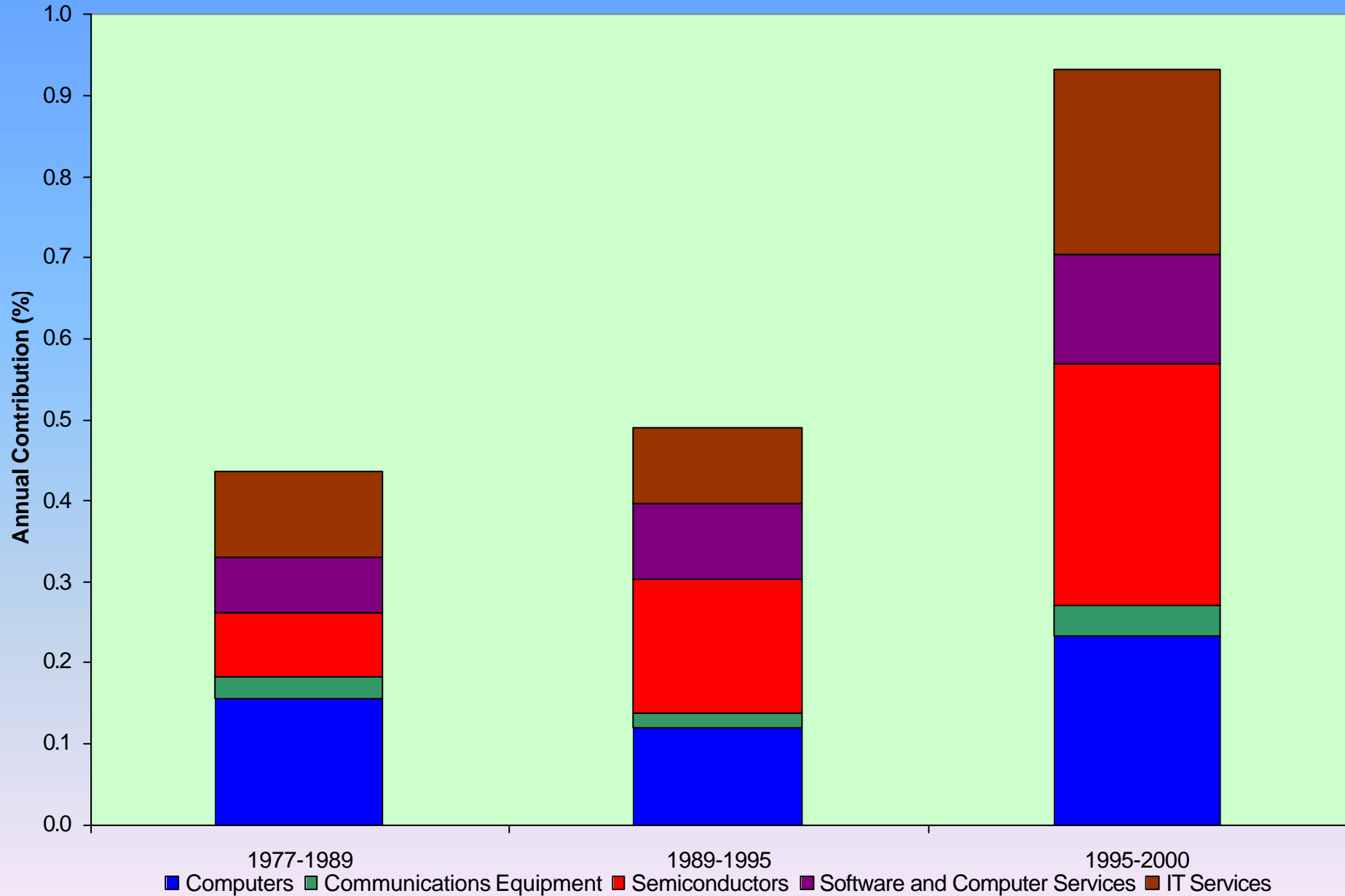
Value Added Shares of Information Technology by Type, 1977-2000

Share of current dollar gross domestic product.



Industry Contributions to Value Added Growth

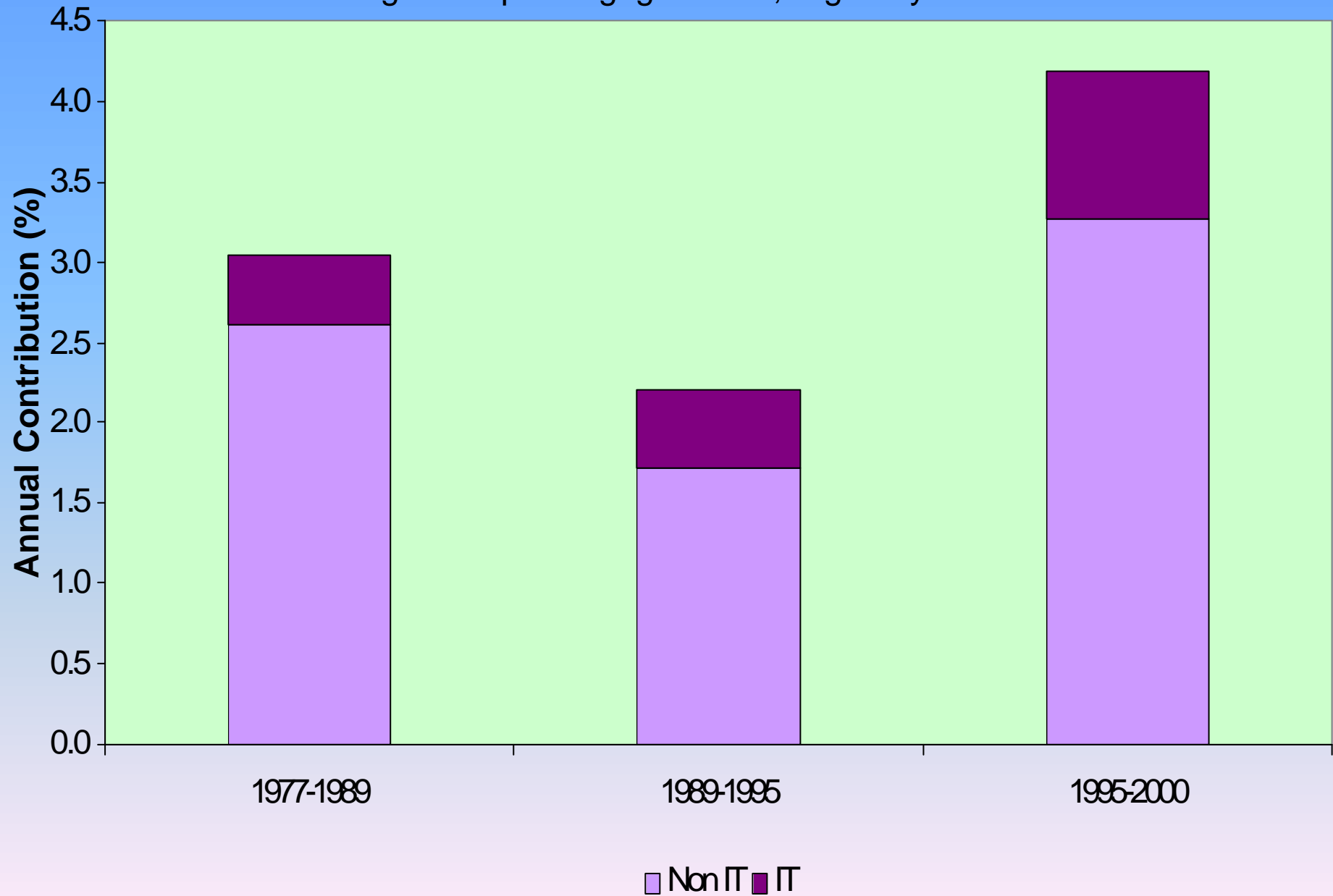
Domar-weighted contrubtions of industry value



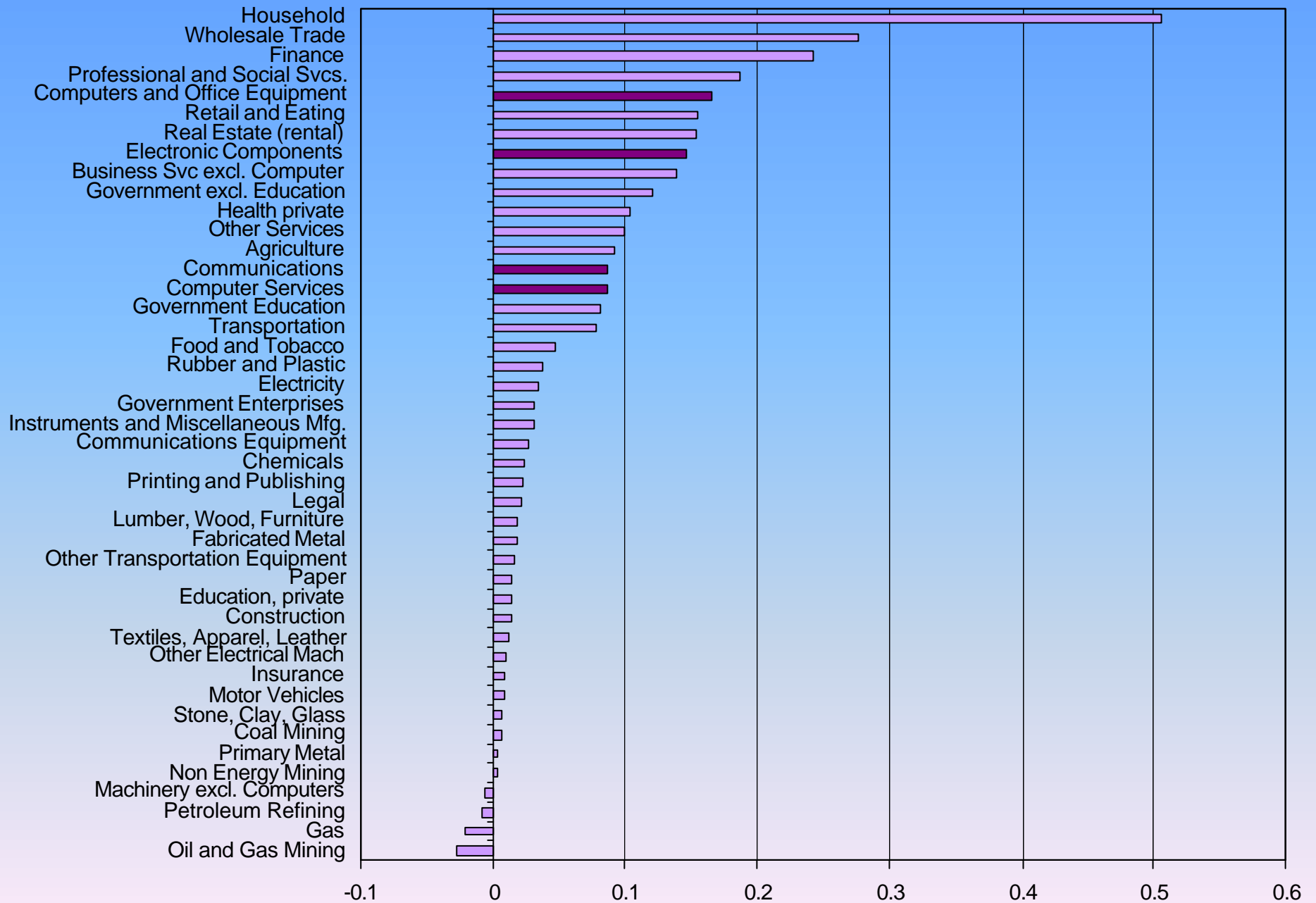
Note: IT Services is the capital service flow from Household and Government

Industry Contribution to Value Added

Average annual percentage growth rates, weighted by the value share.



Industry Contributions to Value Added Growth, 1977-2000



ROLE OF INFORMATION TECHNOLOGY: IT Prices, Investment, and Productivity.

INPUT SHARES OF IT:

Computers, Communications Equipment, and Software.

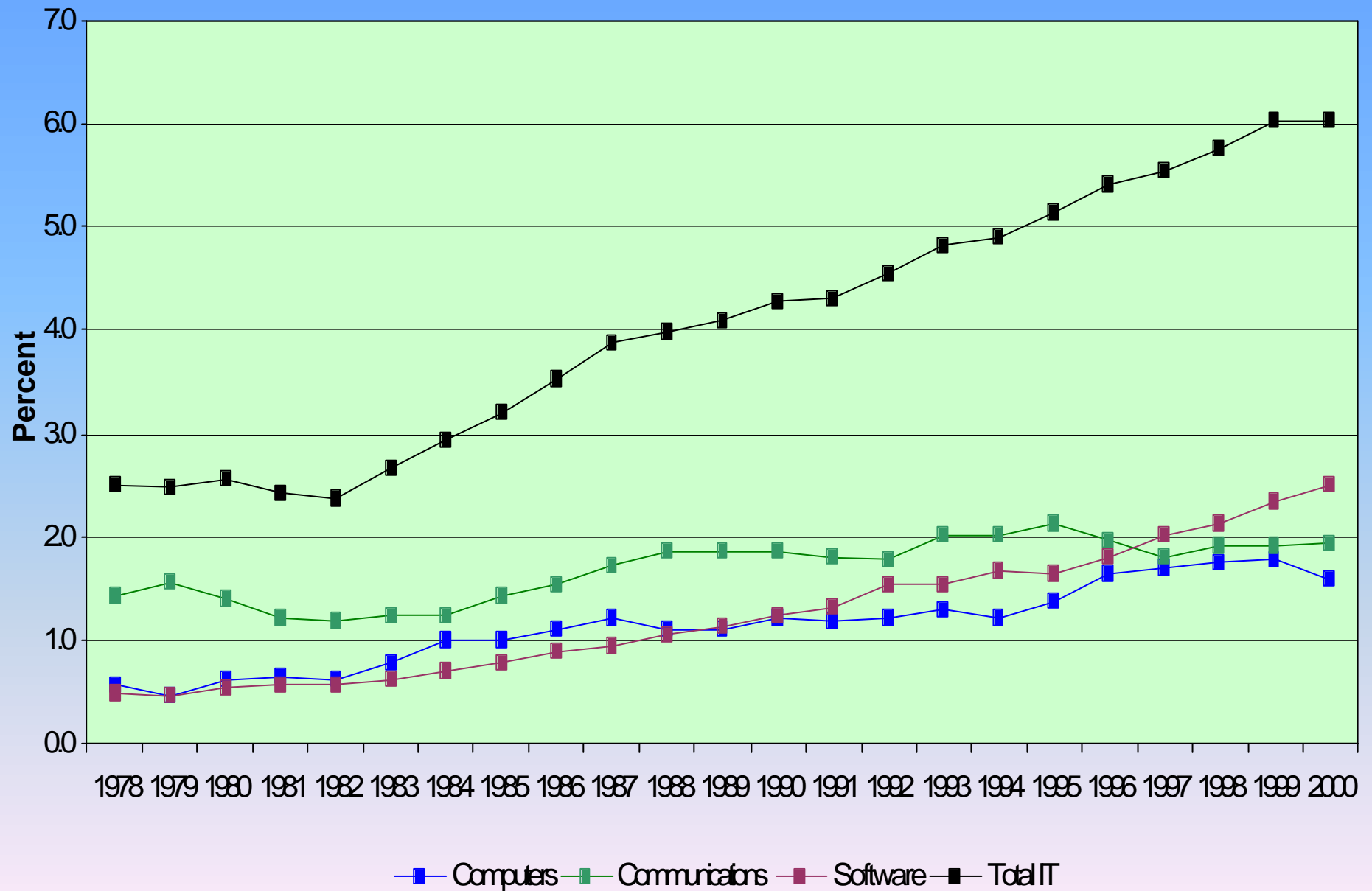
CAPITAL CONTRIBUTION:

IT versus Non-IT Capital Services.

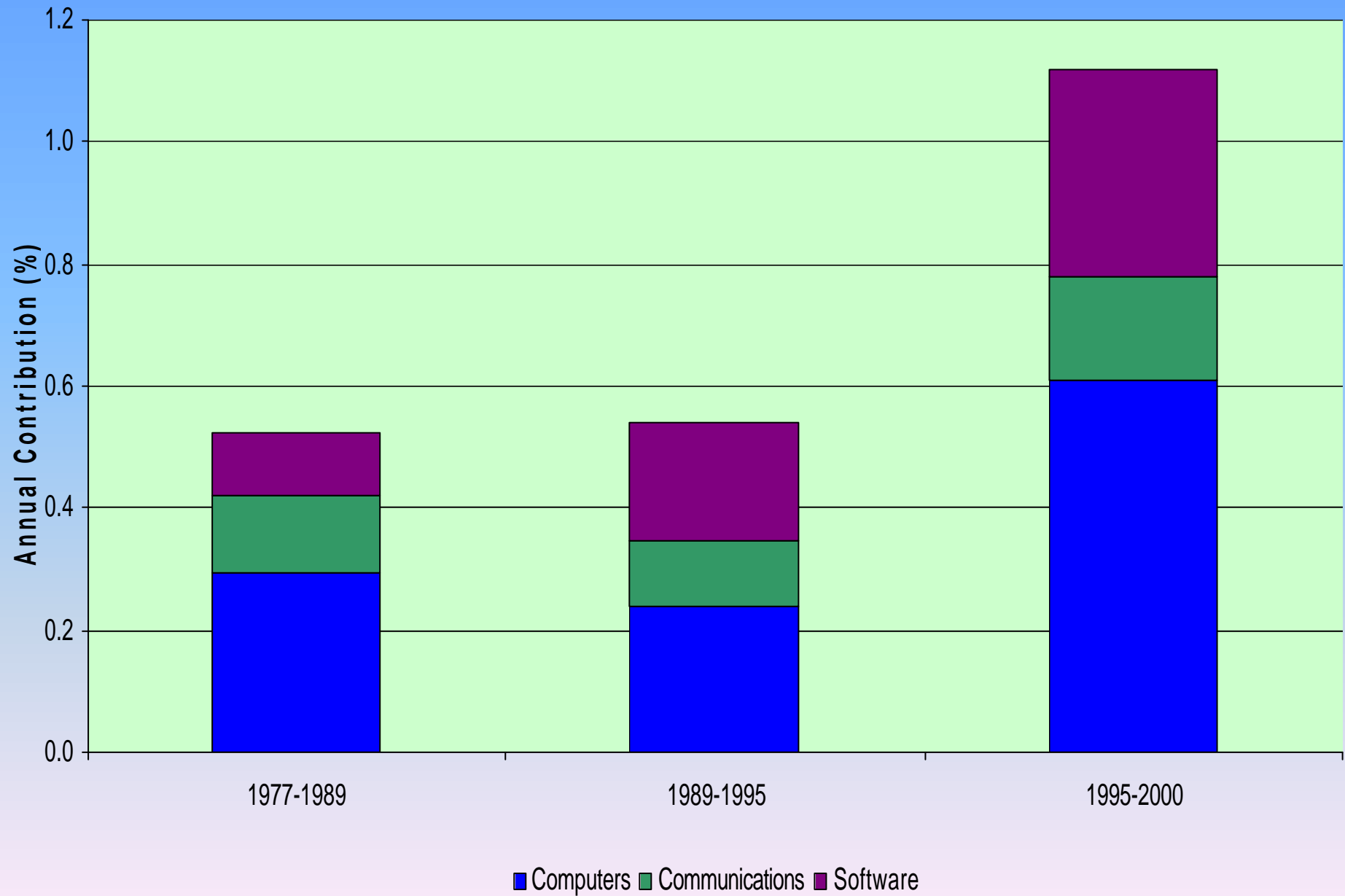
CAPITAL CONTRIBUTION BY TYPE:

Computers, Communications Equipment, and Software.

IT Capital Input Shares by Type

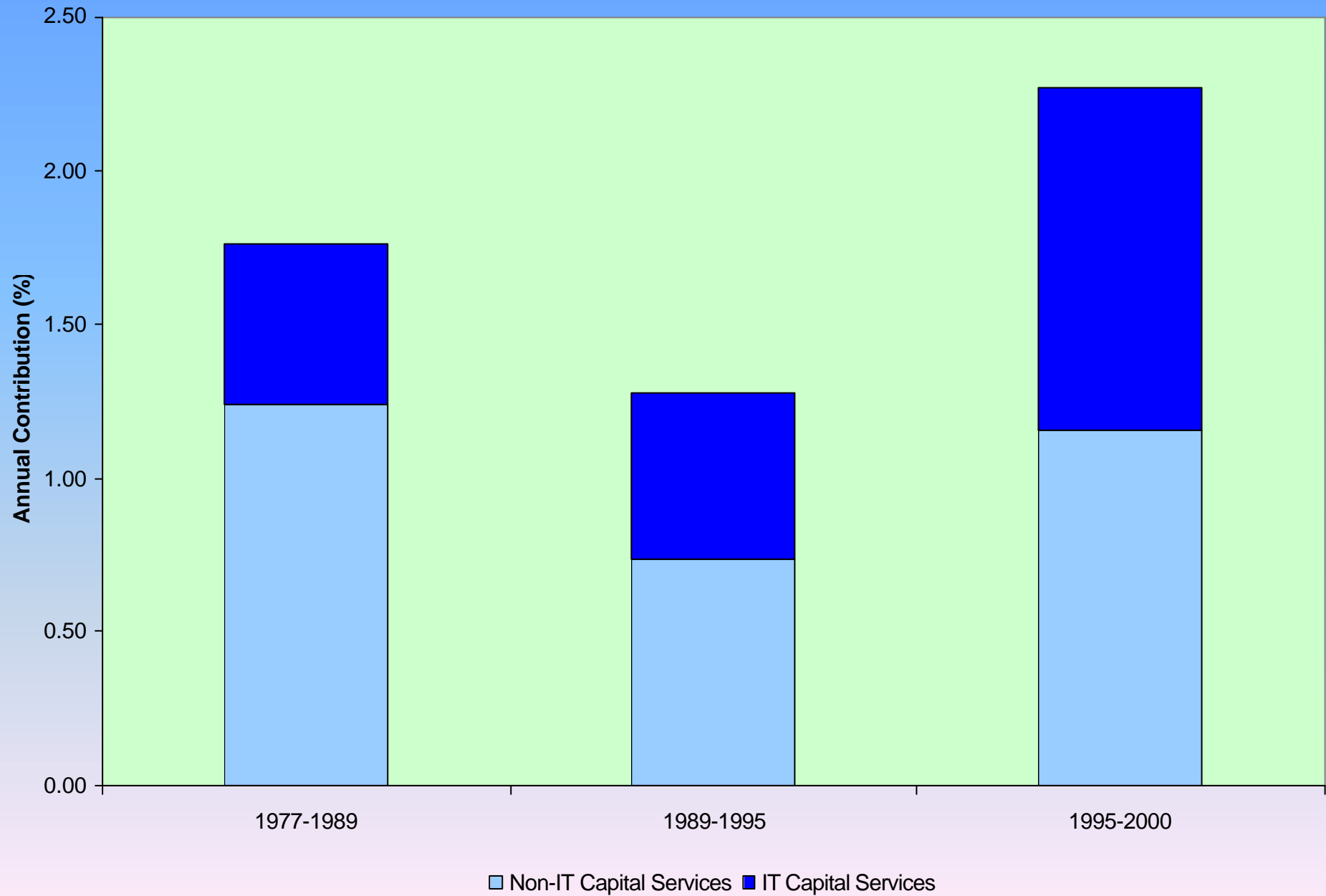


Components of IT Capital Input Contribution

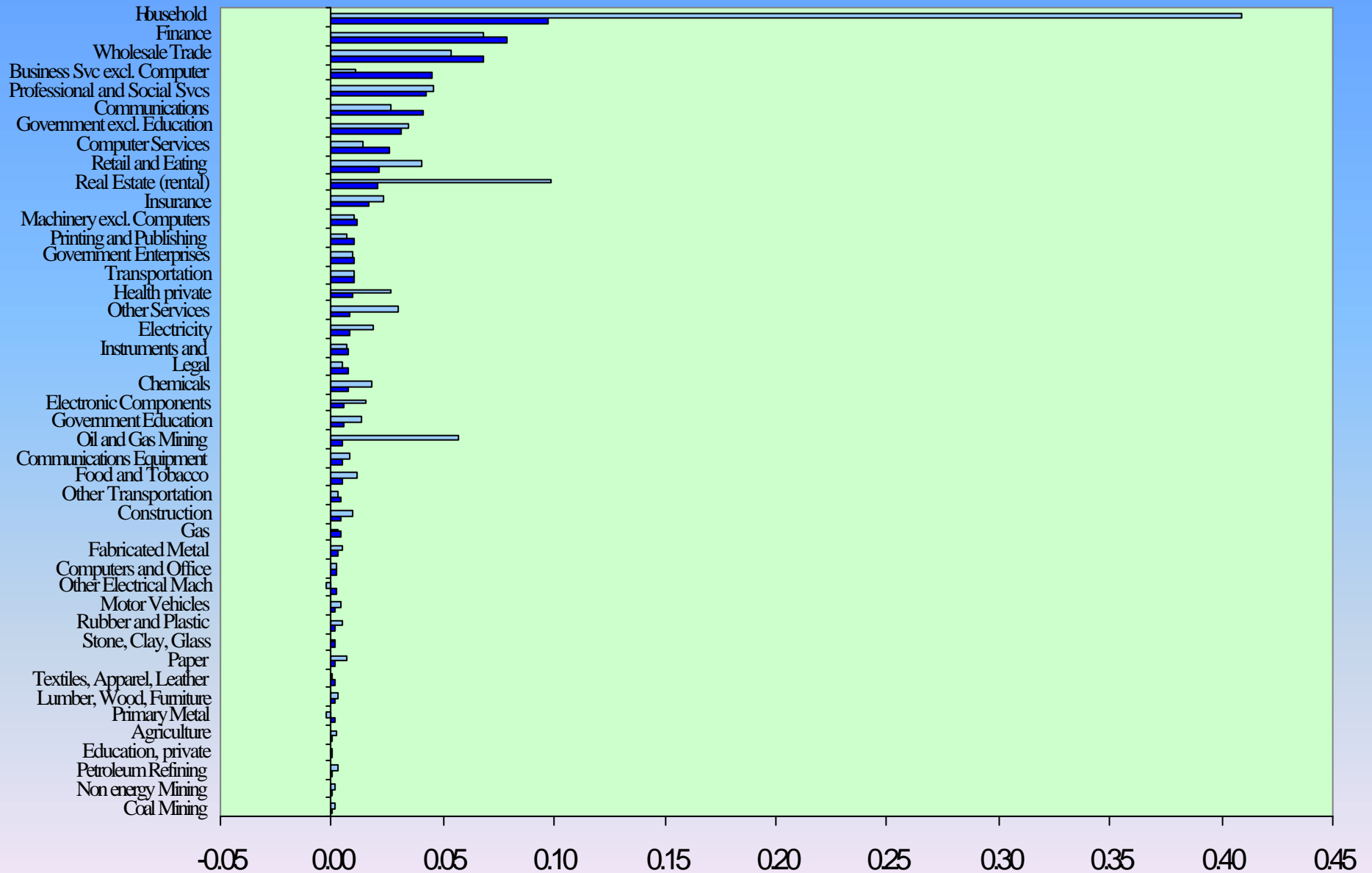


Capital Input Contribution of Information Technology

Average annual percentage growth rates, weighted by income



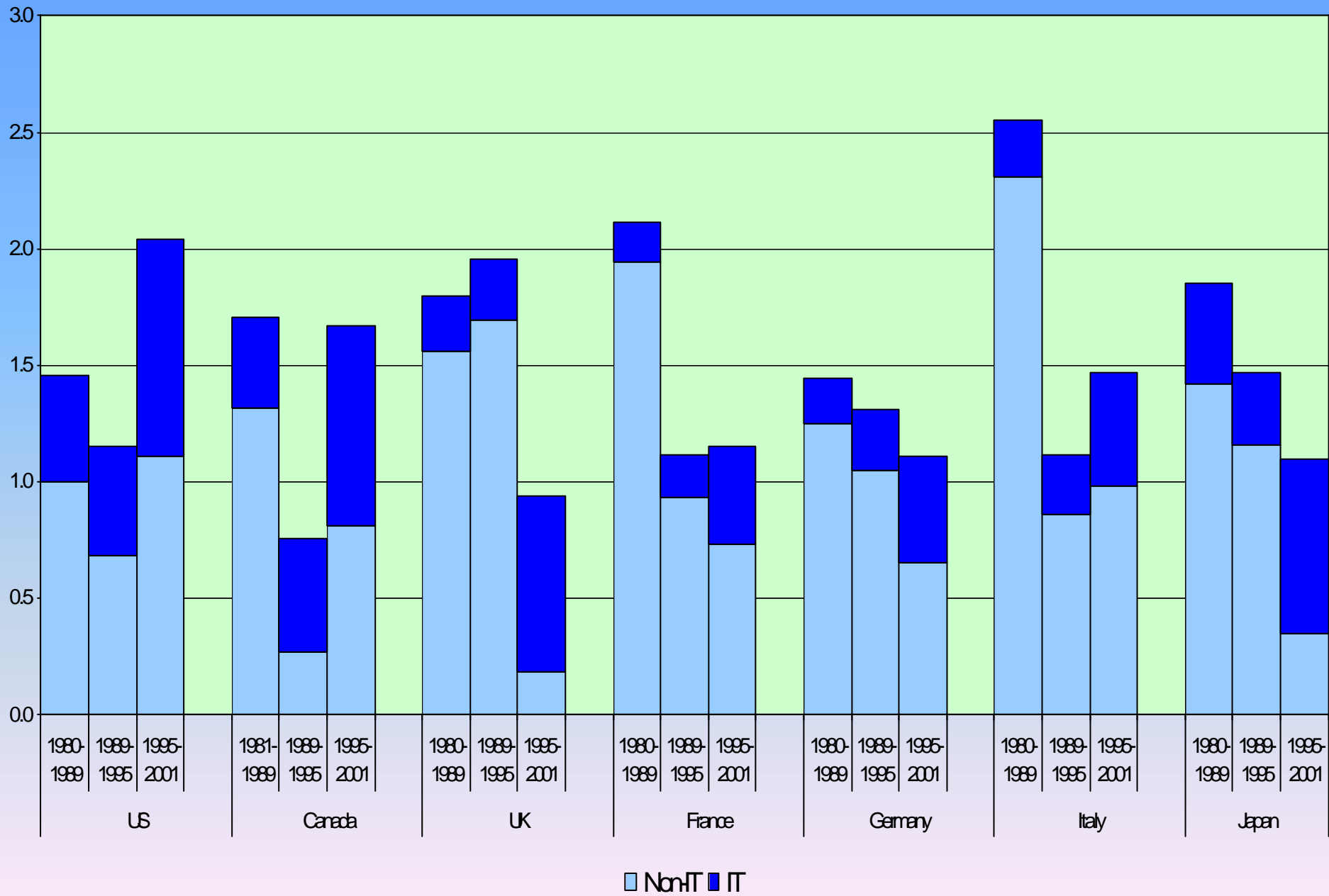
Industry Contributions to Capital Input Growth, 1977-2000



Note: Industries sorted by IT capital contribution.

■ IT Capital ■ Non-IT Capital

Capital Input Contribution by Country



AMERICAN GROWTH RESURGENCE: IT Investment and Productivity Growth.

TOTAL FACTOR PRODUCTIVITY:

IT-Production versus Non-IT Production.

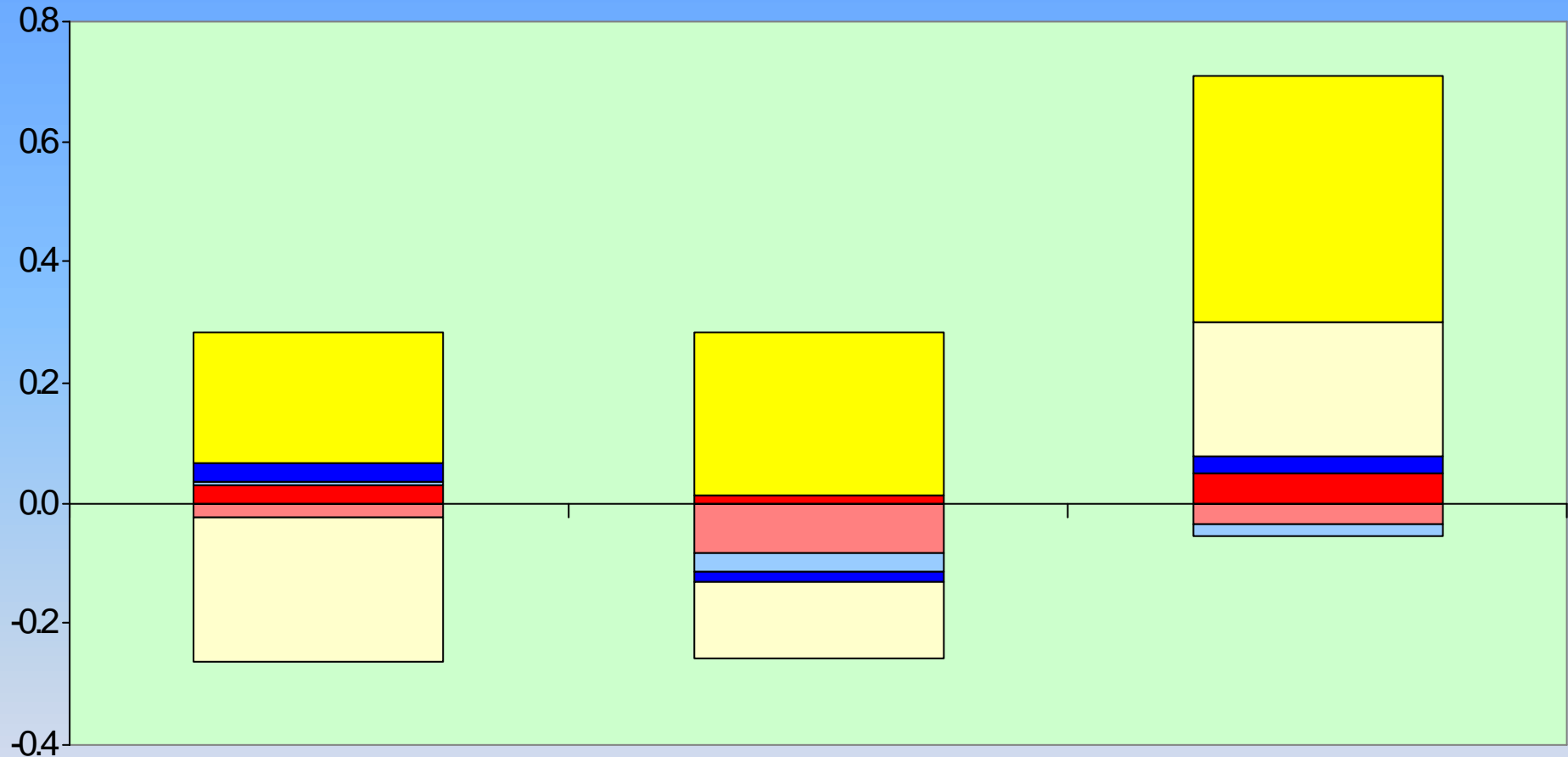
SOURCES OF U.S. ECONOMIC GROWTH:

Capital Input, Labor Input, and TFP.

AVERAGE LABOR PRODUCTIVITY GROWTH:

Capital Deepening, Labor Quality, TFP.

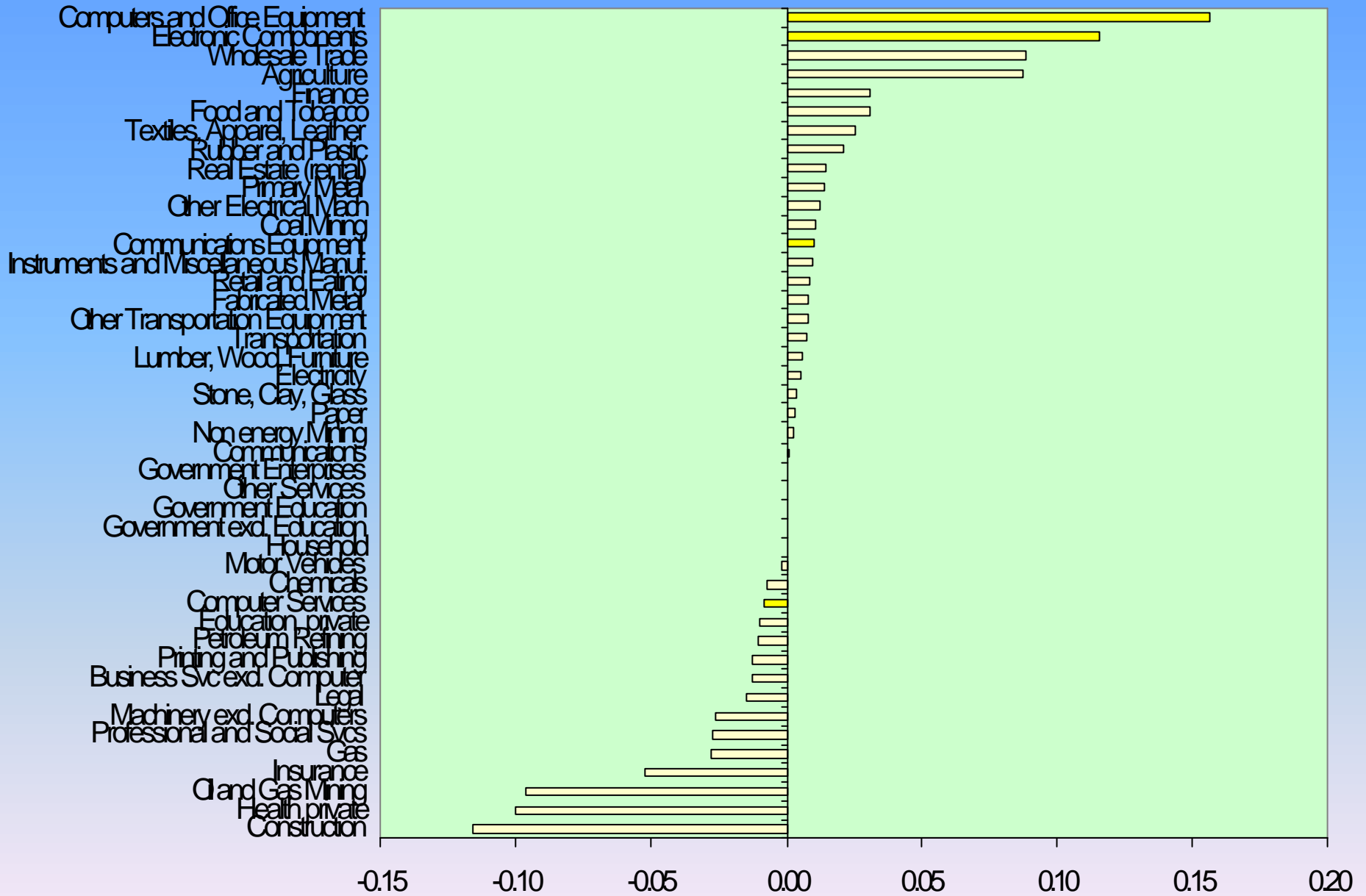
Sources of U.S. TFP Growth



- Reallocation of Non-college Educated Labor
- Reallocation of Non-IT Capital
- Wgt. Sectoral TFP (Other)

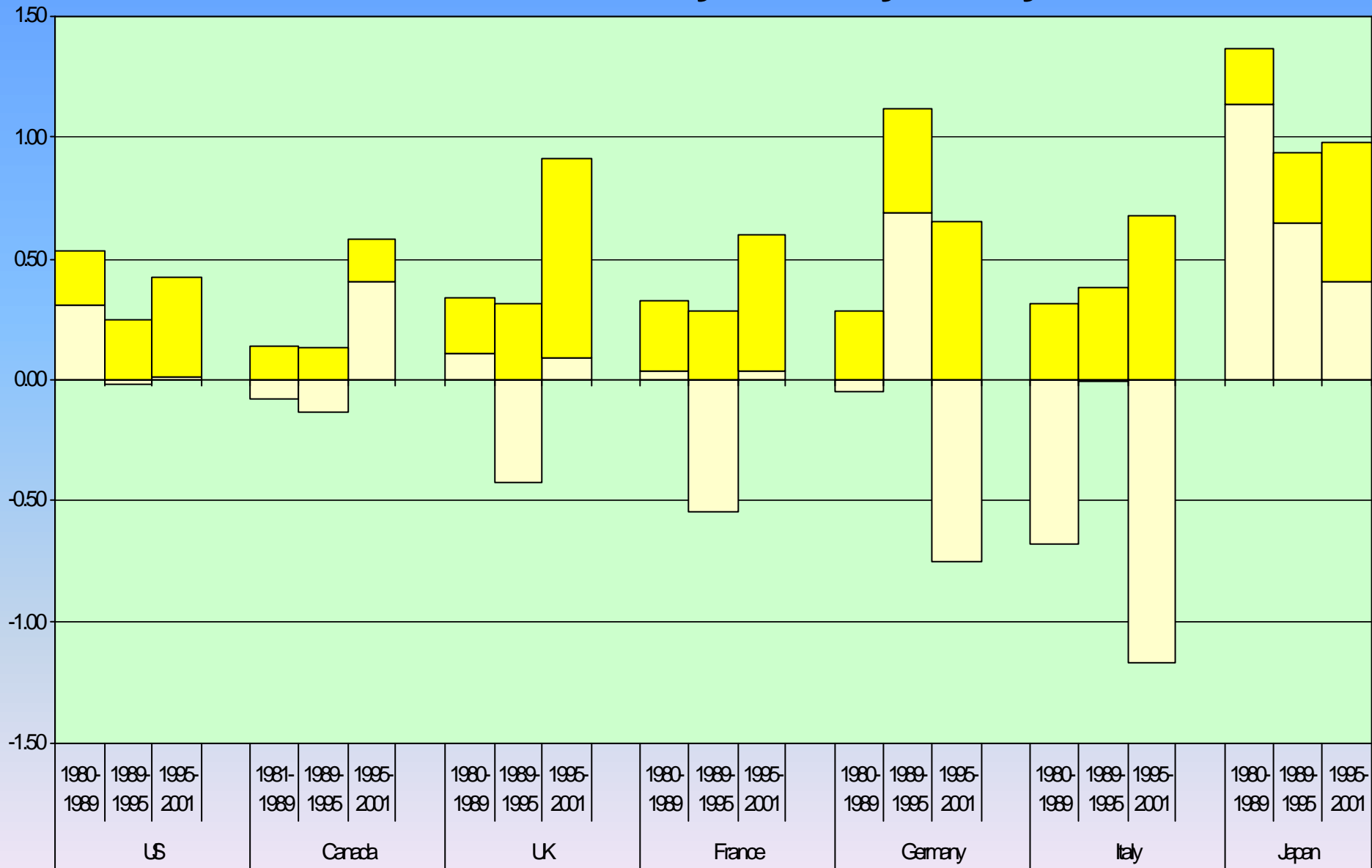
- Reallocation of College Educated Labor
- Reallocation of IT Capital
- Wgt. Sectoral TFP (IT Producers)

Industry Contributions to Productivity, 1977-2000



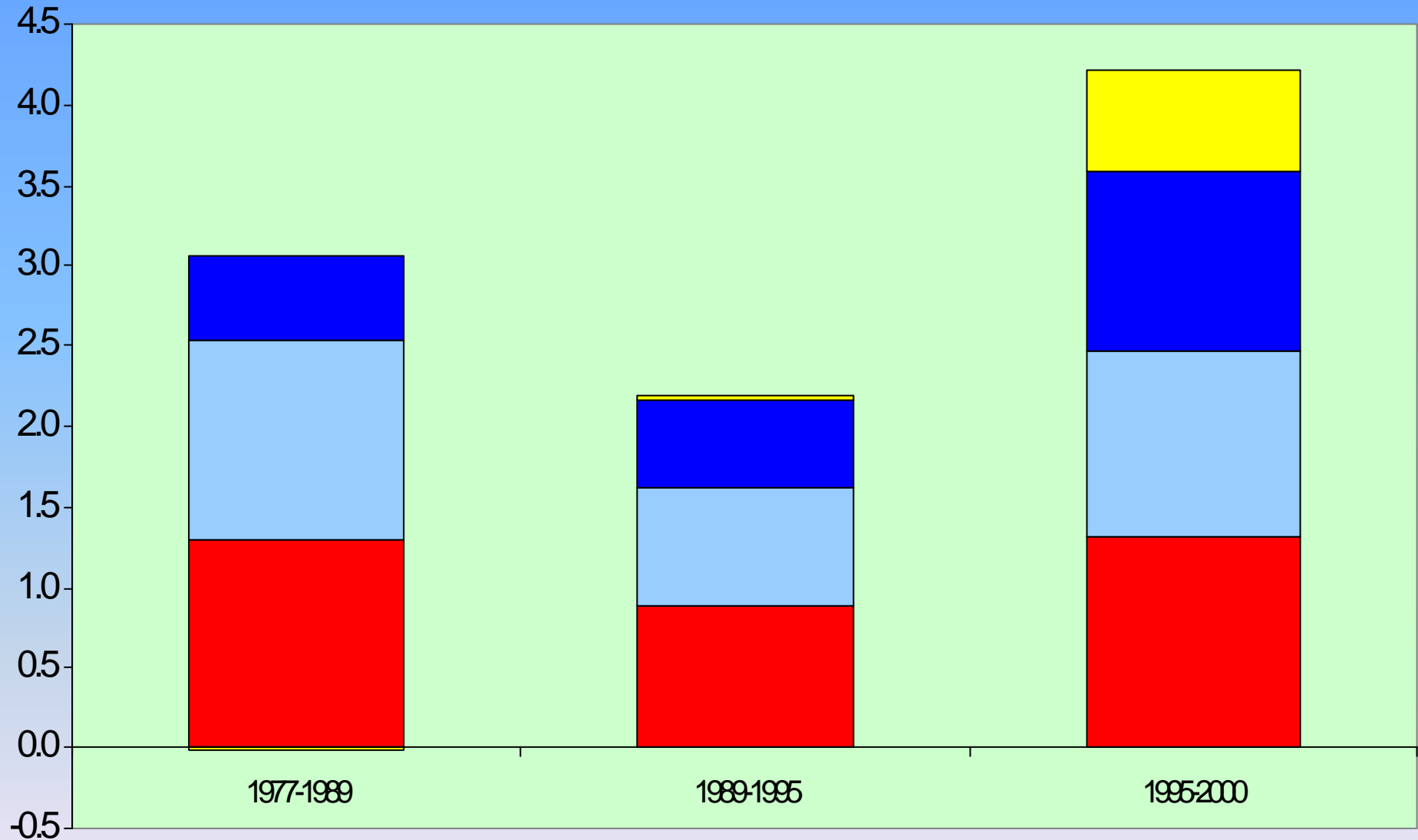
Note: Industries sorted by productivity contribution.

Sources of Productivity Growth by Country



□ NonIT ■ IT

Sources of U.S. Economic Growth



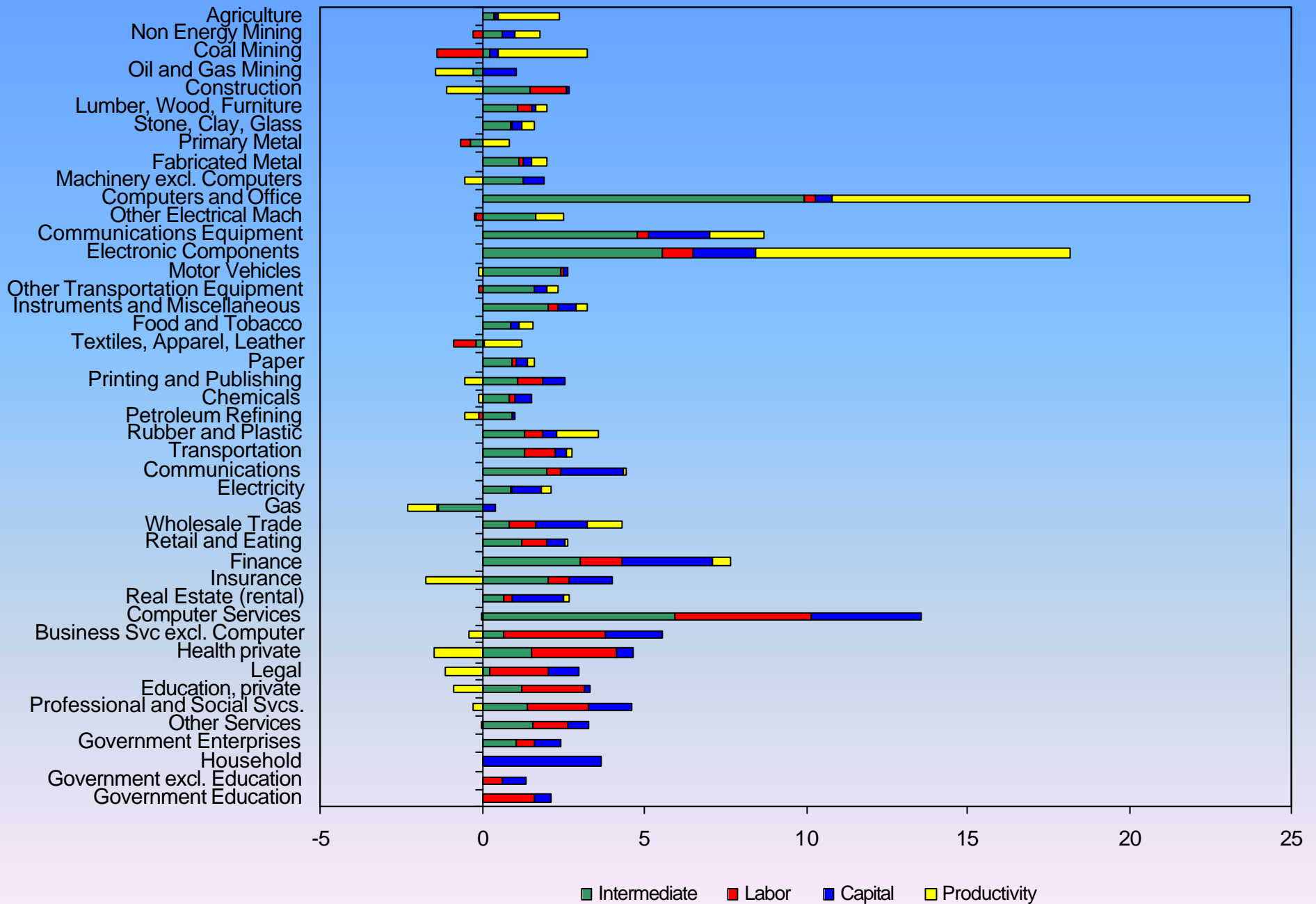
■ Labor

■ Non-IT Capital

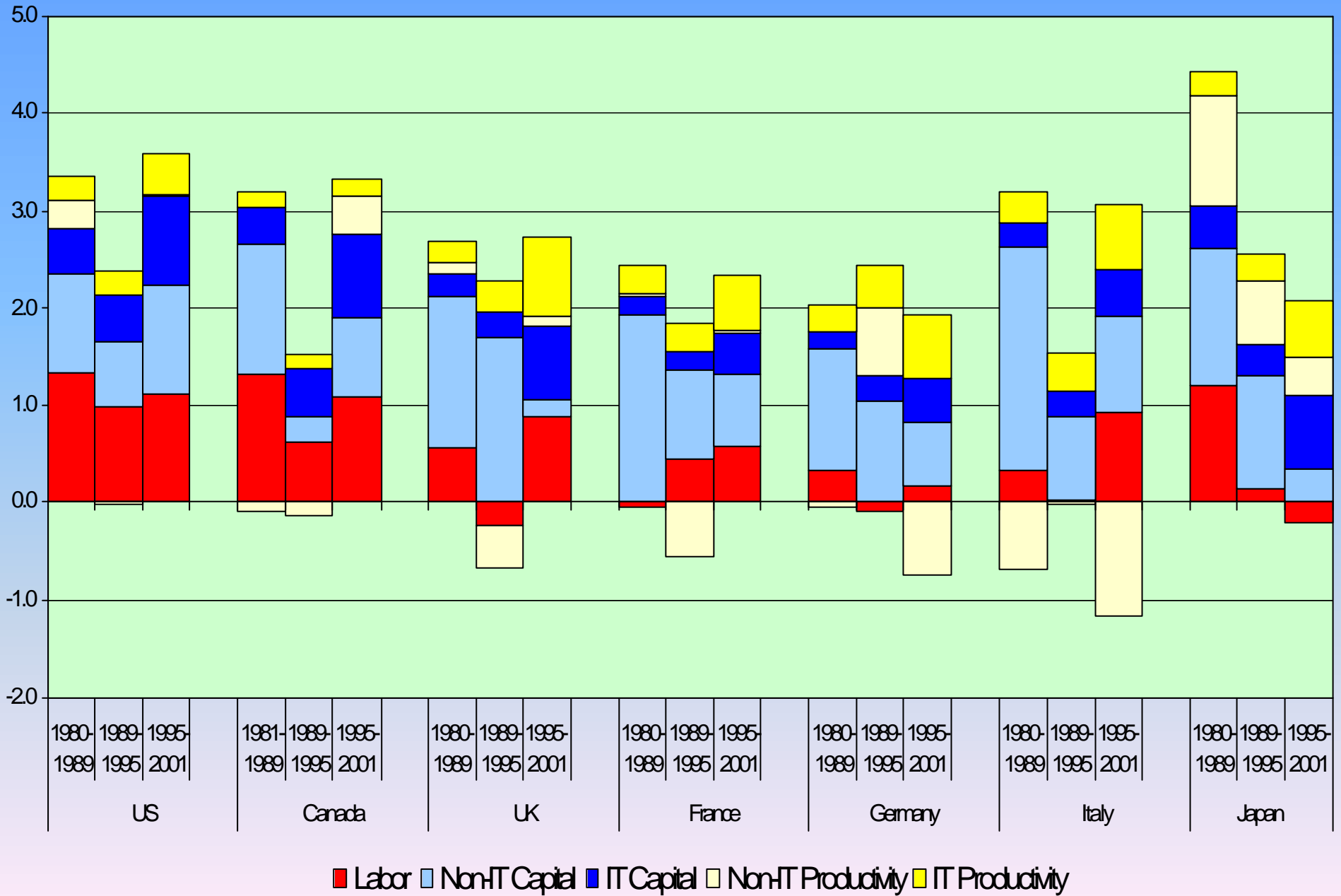
■ IT Capital

■ TFP

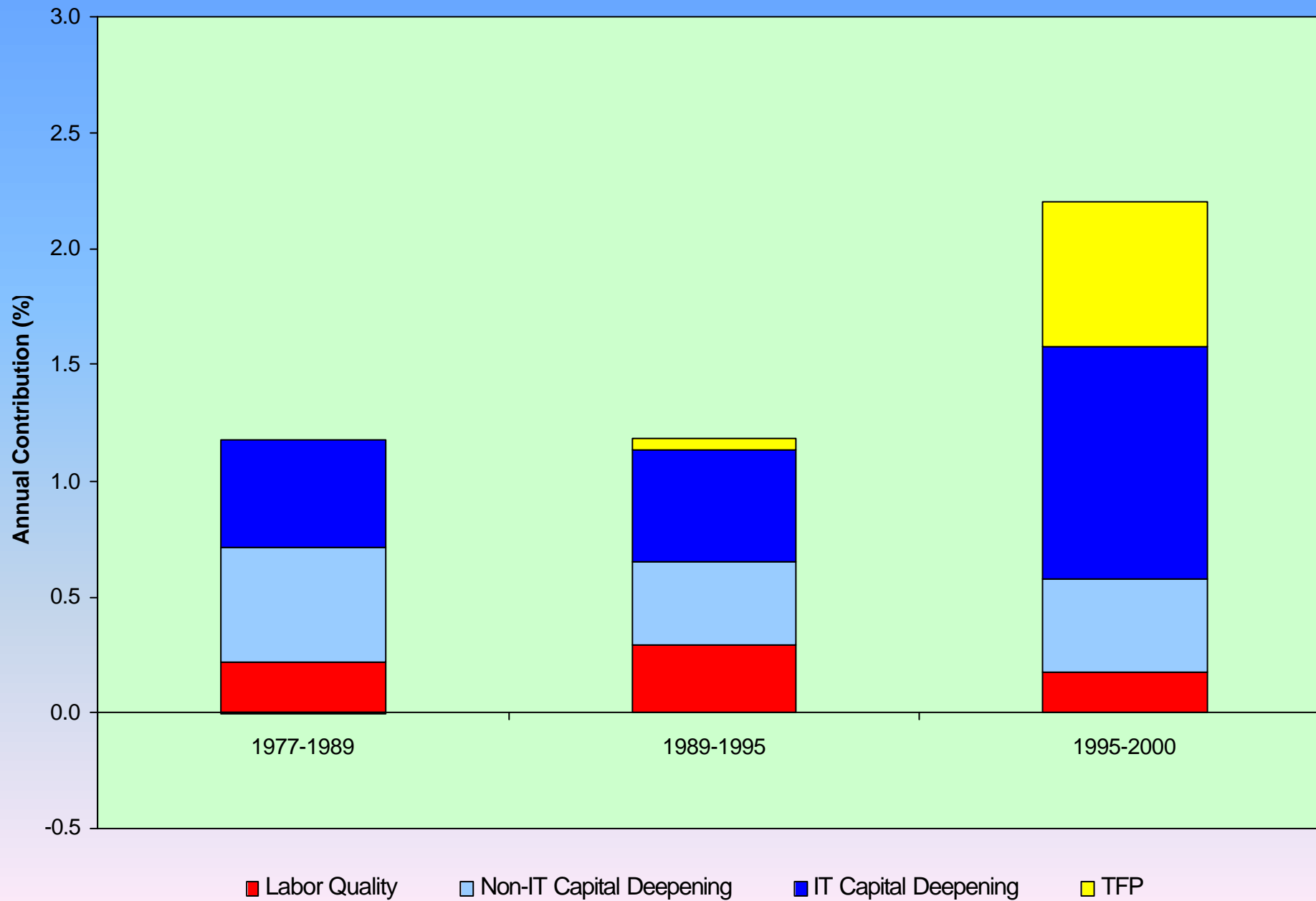
Sources of Growth in Industry Output, 1977-2000



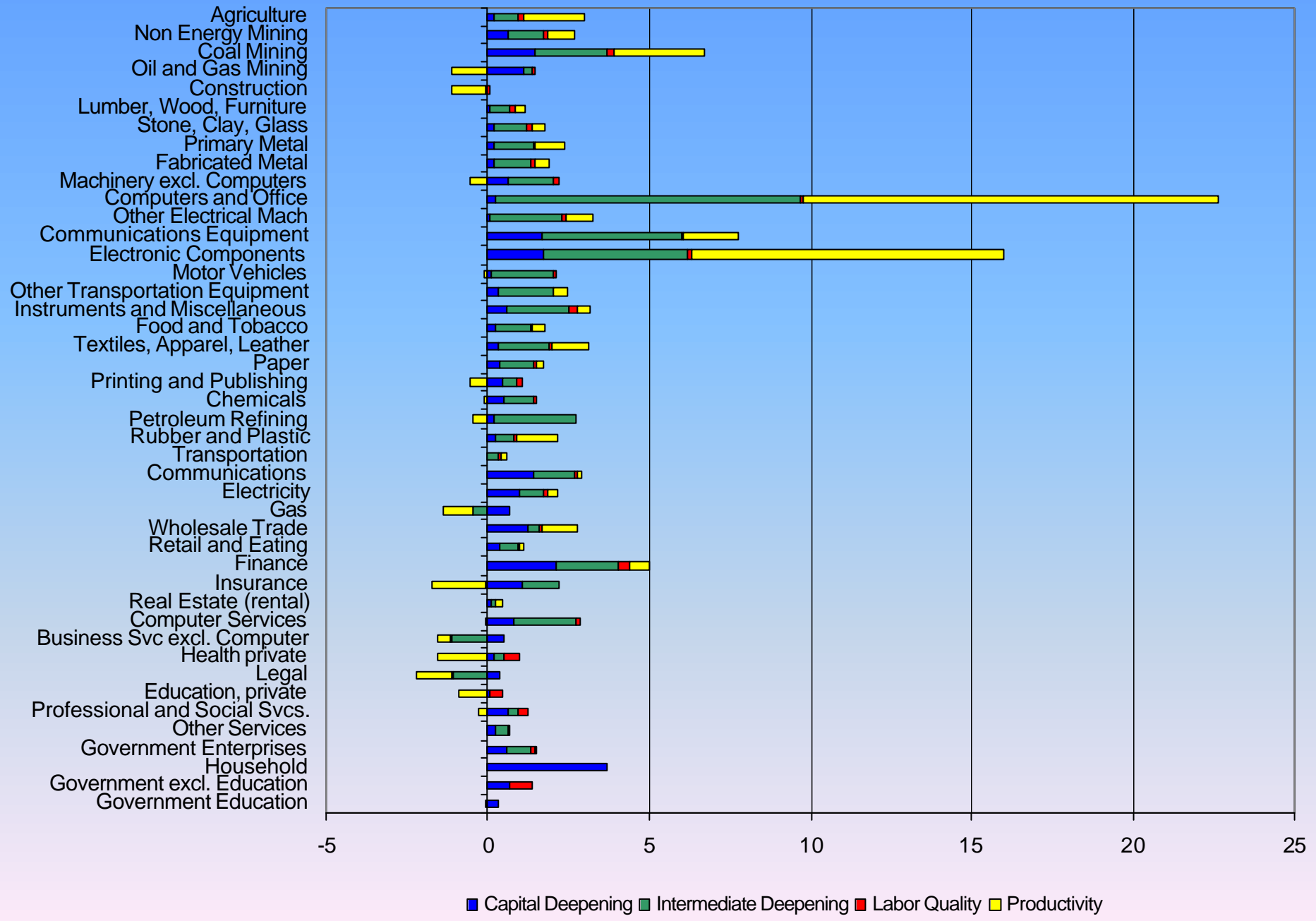
Sources of Economic Growth by Country



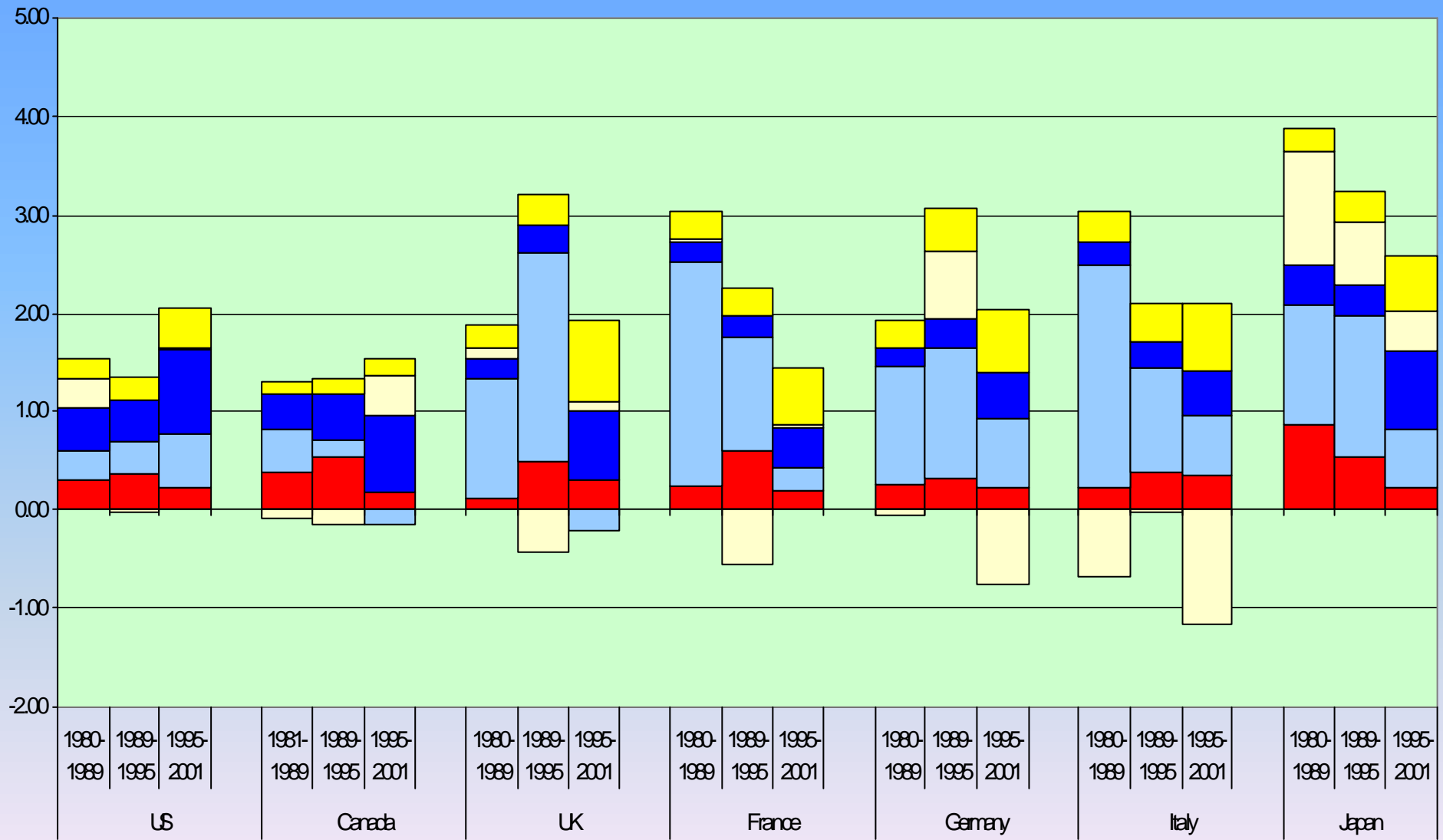
Sources of U.S. Labor Productivity Growth



Sources of Industry Labor Productivity Growth, 1977-2000



Sources of Labor Productivity Growth by Country



■ Labor Quality
 ■ Non-IT Capital Deepening
 ■ IT Capital Deepening
 ■ Non-IT Productivity
 ■ IT Productivity

ECONOMICS ON INTERNET TIME: The New Research Agenda.

- The Solow Paradox -- we see computers everywhere but in the productivity statistics -- versus the Information Age.
- Equity Valuations and Growth Prospects: accumulation of intangible assets versus irrational exuberance.
- Widening Wage Inequality: capital-skill complementarity versus skill-biased technical change.
- Modeling IT and the semiconductor industry: permanent versus transitory contributions to economic growth.