U.S. COMPETITIVENESS 2001

Council on Competitiveness

U.S. COMPETITIVENESS 2001:

Strengths, Vulnerabilities and Long-Term Priorities

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CHAIRMEN'S INTRODUCTION

Although the performance of the U.S. economy is not governed by election cycles, the start of a new Administration and Congress is a natural time to assess the state of U.S. competitiveness. The uncertainty of the current economic outlook demands a clear understanding of why America prospered over the last decade, where economic performance fell short, and what it will take to meet the rising bar of global competition.

U.S. Competitiveness 2001 takes a fresh look at America's competitive position. Although much has changed in the economic landscape since the Council was established in the mid-1980s, our definition of national competitiveness remains the same. It is the capacity to increase the real income of all Americans by producing high-value products and services that meet the test of world markets.

Until recently, a decade of stunning resurgence masked the weak spots in the American economy. The 1990s marked the longest period of economic expansion in the nation's history. The United States outperformed every advanced industrial economy in growth, productivity, capital investment, entrepreneurial activity and fiscal discipline.

The report highlights the growing role of innovation as a source of U.S. economic success. The capacity to translate knowledge into high-value, even unique, products and services has emerged as the nation's most important competitive asset. The Council's analysis shows that the impact of innovation has not been limited to the "new" economy, but rather boosted productivity and growth across the board.

However, our assessment points up serious shortfalls in the nation's competitive position, including skills shortages, an erosion in the basic innovation infrastructure, a gap between domestic savings and investment, and a widening current account deficit. These are critical vulnerabilities that have the potential to undermine U.S. performance over the long term.

Assessing future U.S. prospects also requires an understanding of the changing dimensions of global competition. The report documents growing capabilities for innovation in many parts of the world, which are intensifying competitive pressures on U.S. industry. As a result, the United States will have to expand its innovative capacity in order to continue to prosper.

Finally, *U.S. Competitiveness 2001* includes, for the first time, a road map of the nation's priorities if it is to sustain an improving standard of living. Although there are many factors that affect competitiveness, the Council's focus is on bolstering the innovative capabilities that will be central to the nation's long-term economic performance. The priorities that stand out include:

LEAD IN SCIENCE AND TECHNOLOGY. Sustained investments in scientific and engineering research since World War II contributed significantly to America's prosperity. The need to maintain a leadership position looms larger than ever in a knowledge-driven world economy. The consensus surrounding the importance of funding basic research, however, began to weaken during the economic boom of the 1990s. Federal support—the mainstay of long-term frontier research—declined as a share of the nation's research investment. The research portfolio became increasingly unbalanced by discipline.

And, the pool of American scientists and engineers shrank overall. Laboratory facilities suffered from the lack of adequate funding for modernization. These trends must be reversed if U.S. technological preeminence is to be assured.

BOOST OVERALL WORKFORCE SKILLS. Technology and globalization have increased the premium on workforce skills. The economy will need more educated and better-trained workers not only to compete, but also to offset a slowdown in the projected growth of the workforce over the next several decades. The nation has much to do just to stay competitive in the skills race. More than 10% of young Americans fail to complete high school, and substantial numbers of those who do lack basic literacy skills. Meanwhile, the fastest–growing and best–paying jobs require two years or more of post-secondary education. The nation's most urgent challenges in boosting workforce skills are to strengthen the foundation of math and science education in K-12, bring underrepresented minorities into the science and engineering workforce, and extend training opportunities to more workers.

STRENGTHEN REGIONAL CLUSTERS OF INNOVATION. In an era in which national boundaries seem less important as capital, technology, and talent move globally, the drivers of innovation are, if anything, more local. Raising awareness of the importance of the role of regional innovation is a critical first step in taking national innovation policy to the next level. Identifying and disseminating best practices to support regional cluster development is another important priority. Above all, the focus of competitiveness and innovation policy must be expanded to encompass the regional level.

The Council on Competitiveness will convene its second National Innovation Summit in April 2001 to develop an action agenda in these areas for the new Administration, Congress, and the nation's governors. *U.S. Competitiveness 2001* will provide the analytic basis for this initiative and for the Council's continuing efforts to sustain American prosperity.

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The report draws on the insights and expertise of many Council members and advisors. Members of the Council's Executive Committee painstakingly reviewed successive drafts. Ongoing careful review by Allen Shiau, long-time Council advisor and President of the Global Economic Consulting Association, was invaluable to the accuracy and credibility of the analysis. Gregory Tassey, senior economist at the National Institute of Standards and Technology, thoughtfully reviewed each draft and worked with us to identify new sources of data. Scott Stern, assistant professor of economics at MIT, helped to develop the analytic framework. Paul Romer, professor of economics at Stanford, provided valuable insights regarding the policy context.

The report would not have been possible without the dedicated efforts of Charles Evans, formerly a senior research associate at the Council and now senior analyst at Deloitte & Touche, and Jackie Mathewson, whose patience and careful attention to detail are without peer.

HIGHLIGHTS OF U.S. COMPETITIVENESS 2001:
Strengths, Vulnerabilities and Long-Term Priorities

IN A NUTSHELL

The uncertainty of the current economic outlook demands a clear understanding of why America prospered during the 1990s, where economic performance fell short, and what it will take to meet the rising bar of global competition.

This report focuses on the challenges that will shape long-term economic prosperity. While the nation's attention will be drawn to the current business cycle and ways to mitigate it, the standard of living of all Americans will hinge over the long run on expanding the national capacity for innovation.

Section I details the causes of U.S. economic resurgence in the 1990s. Two-thirds of GDP growth was attributable to increases in productivity growth and capital stock per worker that, in turn, were driven by investment in and deployment of new technologies. Productivity growth, along with supportive monetary policy, enabled full employment without inflation. Vibrant entrepreneurial activity—much of it in technologically-intensive fields such as information technology and health—spurred the creation of millions of new businesses and jobs. Fiscal discipline freed up capital for private investment. The extended expansion, therefore, was built on strengths in all the key components of economic growth.

Section II highlights persistent areas of weakness that have the potential to undermine longer-term prosperity. Forty percent of American households did not enjoy the income benefits of the long economic expansion. The income gap between rich and poor households continued to widen—evidence of a growing skills and education gap between Americans and a failure to make the most of the nation's human resources. Low domestic savings did not meet investment needs, forcing a growing reliance on foreign sources of capital for investment. This drove the current account deficit to record levels. Less obvious, but of critical importance, were declines in the share of national resources committed to frontier research and decreasing numbers of science and engineering degrees in every field outside the life sciences. This undercut the long-term U.S. capacity for innovation; the required levels of R&D investment and technical talent cannot be declining in an economy driven by knowledge creation and the deployment of technology.

Section III explains why an increasing commitment to innovation is necessary just to maintain the position of the United States, much less improve in relative terms. The bar for competitiveness is rising because the global capacity for innovation is growing. The elements of innovative capacity that powered U.S. leadership in cutting-edge technologies are now globally available. Many nations are boosting research investment and surpass the United States in developing human capital. Other nations are also catching up in information technologies.

Section IV explores some of the policy priorities for sustaining long-term competitive advantage. Of central concern to the Council are technology, education and skills, and regional innovative capacity. Technological leadership is rooted in national investments in frontier research, a national cadre of scientists and engineers and state-of-the-art research facilities. In each of these areas, U.S. innovation capabilities are eroding. These trends must be reversed to assure future prosperity.

A world-class workforce is the baseline requirement for global competitiveness. The bar for skills is rising – a result of competition from lower-wage, but increasingly better educated, workers overseas and the demands of rapid technological change at home. The fastest growing—and best-paid—jobs will require some level of postsecondary education. There is evidence, however, that demand for education and skills is outstripping supply and that the fastest growing segments of the population are least prepared for the modern economy. The implications for the social cohesion of the country are reason enough for concern, but the economic consequences are profound as well. The impending retirement of millions of baby boomers will leave a smaller and relatively less educated and experienced workforce. The ability to maximize the productive potential of every American of working age, through investment in education and training, will be essential to sustain future growth.

Finally, the locus of innovation that powers national prosperity is increasingly regional. Achieving a more rapid national pace of innovation will require explicit recognition of and support for the critical role of states and localities in fostering clusters, or geographic concentrations of firms, suppliers and related institutions in particular fields. Clusters innovate faster because they draw on local networks that link technology, resources, information and talent. Strong competitive pressures on the ground, not hundreds or thousands of miles away, increase a cluster firm's motivation and ability to innovate. Clusters build the basis for specialized skills and capabilities and enable competitive advantage in world markets.

THE DATA HIGHLIGHTS

What Drove U.S. Prosperity

- Post-1995 growth in GDP per capita reached quarter century highs.
- Investment in information technology played a critical role in boosting capital stock per worker and productivity growth.
- High productivity growth and supportive monetary policy permitted full employment with low inflation.
- Entrepreneurial activity created an estimated one-third of new jobs between 1990 and 1997.
- Fiscal discipline freed up capital for private investment.
- The United States led the world in patenting, the best single measure of innovation.
- Expanding global market opportunities reinforced U.S. competitive advantages in innovation-intensive sectors: advanced services, high-technology products and licensing of intellectual property.

Where Economic Performance Fell Short

- Forty percent of U.S. households did not prosper for most of the 1990s – and U.S. income inequality was the highest in the industrialized world.
- National investment in frontier research lagged.
- Enrollments and degrees in science and engineering, outside of life sciences, began a downward trajectory.
- Personal savings rates hit lows not seen since the Great Depression.
- The current account deficit exceeded 4% of GDP, increasing U.S. dependence on foreign capital.

Why U.S. Leadership Will Be Challenged

- More nations are acquiring high-end innovation capabilities with concerted investment in research and development (R&D) and technical talent. Other nations are acquiring fast-follower capabilities to rapidly commercialize innovation originating elsewhere.
- The supply of scientists, engineers and technicians is growing substantially faster abroad than in the United States.
- The U.S. first-mover advantage in information technology (IT) is diminishing with aggressive IT investment and deployment overseas.

INNOVATION POLICY PRIORITIES

Lead in Science and Technology

- Increase national investment in frontier research
- Balance the nation's R&D portfolio in fundamental disciplines that have been neglected
- Expand the pool of U.S. scientists and engineers
- Modernize the nation's research infrastructure

Boost Overall Workforce Skills

- Improve math and science education
- Provide access to information technology for all students
- Raise post-secondary enrollment rates for underrepresented minorities
- Increase access to higher education for students from low-income households
- Extend training opportunities to more workers

Strengthen Regional Clusters of Innovation

- Expand the focus of competitiveness and innovation policy to the regional level
- Support regional leadership initiatives and organizations that enhance and mobilize cluster assets
- Identify best policy practices in cluster development

SECTION 1

America's Competitive Resurgence: What Drove U.S. Prosperity

Innovation played a pivotal role in the unprecedented economic prosperity of the United States during the 1990s. Virtually all of the macro-economic components of resurgence can be linked to the creation and deployment of new technologies. Greater efficiencies in production and the widespread integration of information technology in new business models added nearly a full percentage point to the nation's productivity growth after 1995. High productivity growth, in combination with sound monetary policy, enabled full employment without inflation. Deployment of new technologies also resulted in a surge in capital investment. The millions of new high-technology firms established over the decade helped to boost the national rate of job creation as well as investment. Although the trade deficit was large, the major areas of U.S. trading strength were innovation-driven. The trade surpluses in R&D-intensive products, high technology services, and licensing of intellectual property reflected the competitive strength of the nation's innovation capabilities.

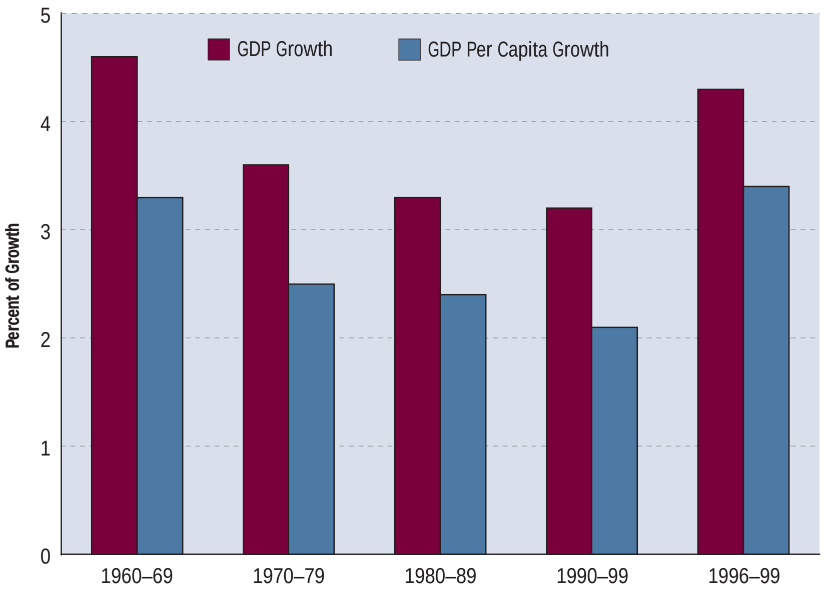
The Economy Made Striking Gains during the 1990s

The performance of the U.S. economy over the past decade confounded the gloomy predictions of the mid-1980s. The longest expansion in the nation's history yielded a surge in growth after 1995. Gross domestic product grew at a pace not seen since the oil crisis of 1973. Per capita growth reached the highest levels in 40 years. This dynamism dispelled forecasts that the world's industrial economies would converge as Asian and European economies caught up with the United States. In fact, the U.S. lead in standard of living, measured by per capita GDP, widened by the end of the 1990s.

CHART 1.1

Post-1995 Growth and GDP Per Capita Reached Quarter-Century Highs

Compound Annual Growth Rate in Real GDP by Decade

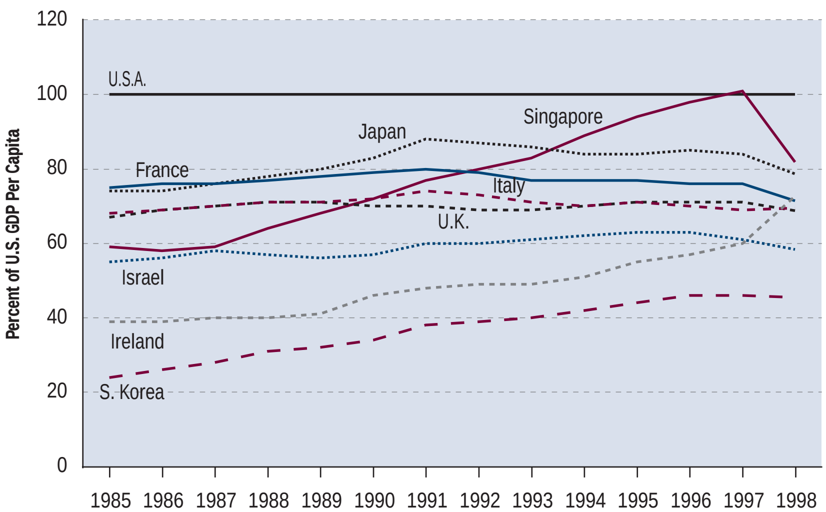


Sources: U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov.
U.S. Census Bureau, www.census.gov.

CHART 1.2

America's Lead in Per Capita GDP Widened during the 1990s

GDP Per Capita Indexed against the U.S., Adjusted for Purchasing Power Parity, Current International Dollars, U.S. =100



Source: World Bank, *World Development Indicators 2000* CD-ROM.

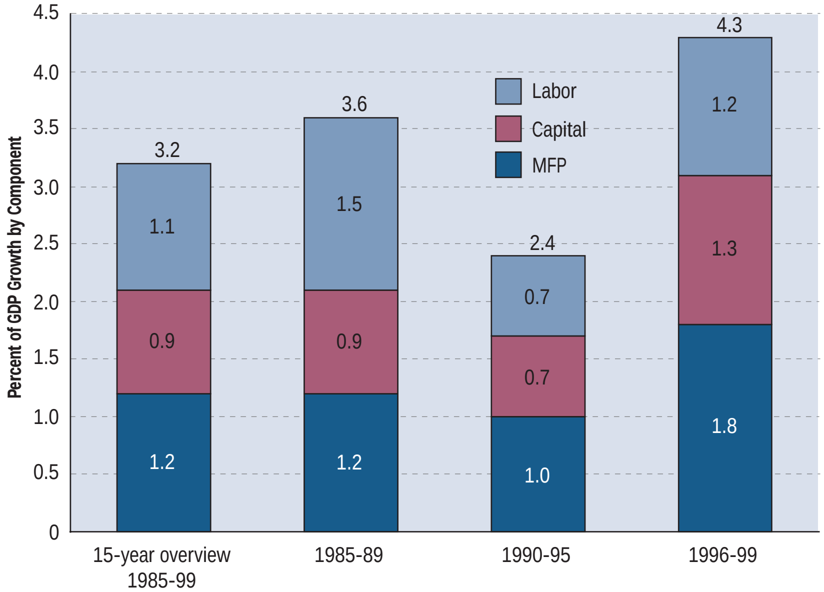
Growth in Labor, Capital Investment and Productivity Drove Economic Expansion

Economic resurgence reflected the impact of three critical components of growth: an expanding pool of labor, robust levels of capital investment and rapid productivity gains. Each of these factors accounted for roughly one-third of recent GDP growth.

CHART 1.3

Increases in Labor, Capital Investment and Multifactor Productivity (MFP) Fueled Economic Resurgence*

Percent Contribution to GDP Growth



*Multifactor Productivity measures the effect of various influences on productivity growth that are not captured by increases in the size of the labor force or in the quantity of capital investment. These influences include technology, the level of experience and quality of workers, increasing competition and more efficient management techniques.

Sources: Council calculation using data from U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov and U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov.

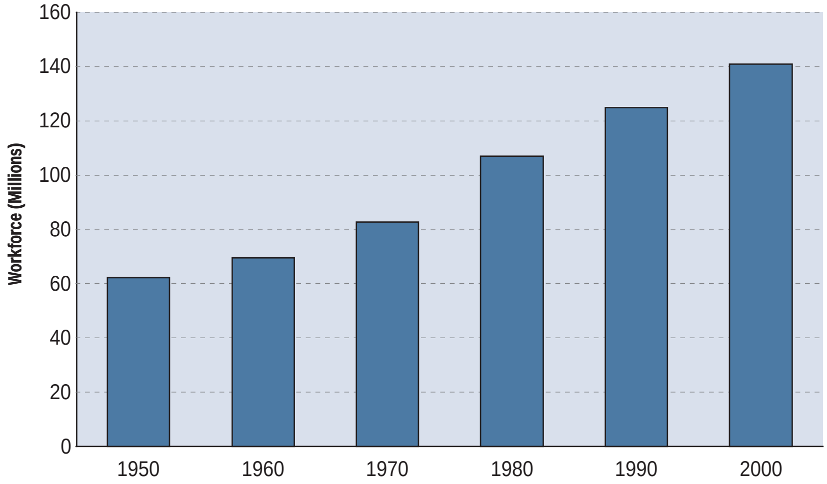
The Workforce Expanded

The workforce grew from roughly 115 million in 1985 to 140 million in 2000, increasing U.S. economic output and reflecting changing labor trends. Young entrants to the labor force were actually declining—a result of the "baby bust" that followed the "baby boom." Workforce growth came from the increased participation of people who had not previously been employed—particularly women and minorities, including immigrants. Future growth may slow because the population is aging and a high percentage of the potential labor pool is already employed. (See Section IV.)

CHART 1.4

A Growing Workforce Boosted Economic Growth

Civilian Workforce, Millions

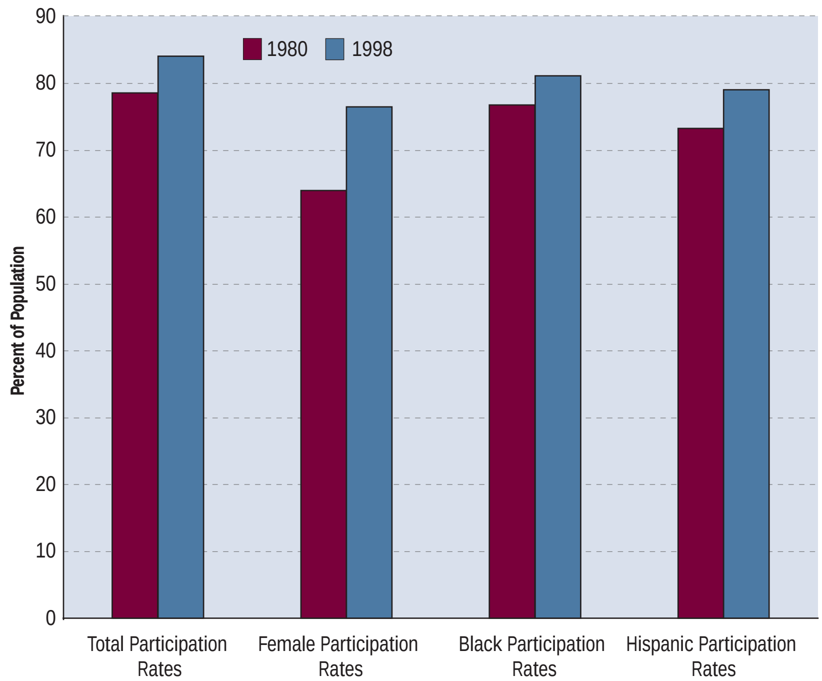


Source: U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov.

CHART 1.5

More Women and Minorities Joined the Workforce

Percent of Population 25–54 Years Old in Civilian Labor Force



Source: U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov.

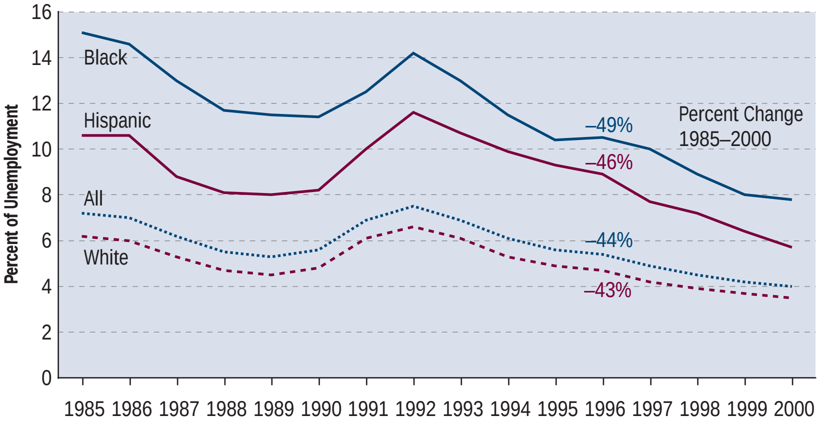
Unemployment Fell Sharply

An additional source of workforce expansion was the 2.5 million decrease in the number of unemployed after 1985. The dynamism of the economy overall and strength of its entrepreneurial sectors contributed to the more effective use of the nation's human resources. The U.S. unemployment rate fell to 4.2% by the end of the decade—well below the historical threshold of a full employment economy. The U.S. unemployment rate was among the lowest in the industrialized world.

CHART 1.6

Unemployment Declined for All Racial and Ethnic Groups

Percent of Unemployment among Civilian Workforce

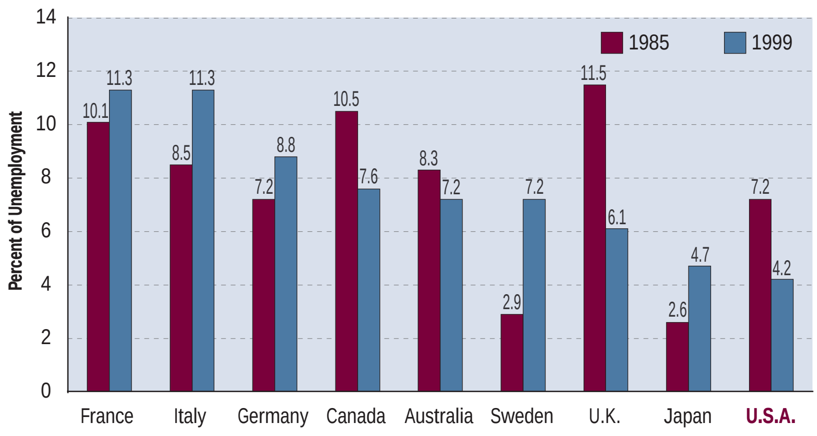


Source: U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov.

CHART 1.7

By 1999, the U.S. Unemployment Rate Was among the Lowest in the Industrialized World

Percent of Unemployment among Civilian Workforce



Source: OECD, *Economic Outlook,* December 1999, June 2000.

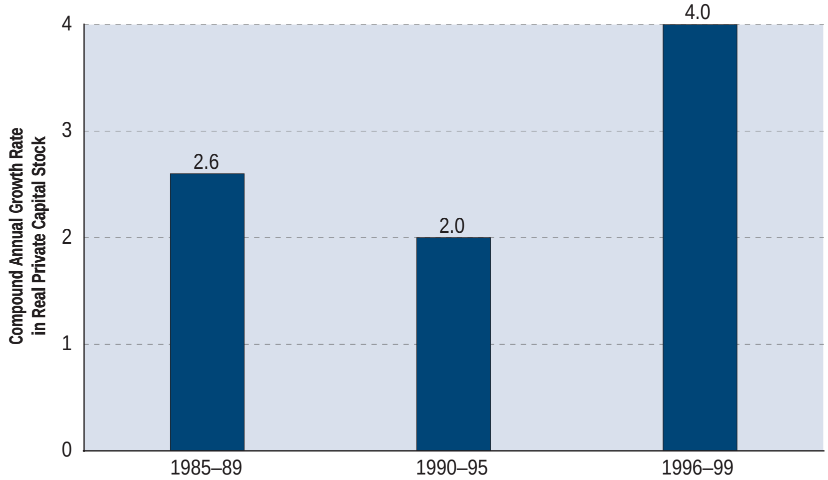
Growth in Capital Stock Soared

While the rate of growth in capital stock in the United States lagged behind most other economies during the 1980s and early 1990s, this trend reversed after 1995. Post-1995 growth averaged 4% per year, a full percentage point higher than the previous decade, and moved the United States into the front ranks internationally in investment in capital per worker.

CHART 1.8

Real Private Investment in Plant and Equipment Took a Major Upturn after 1995

Compound Annual Growth Rate in Real Net Private Non-residential Capital Stock

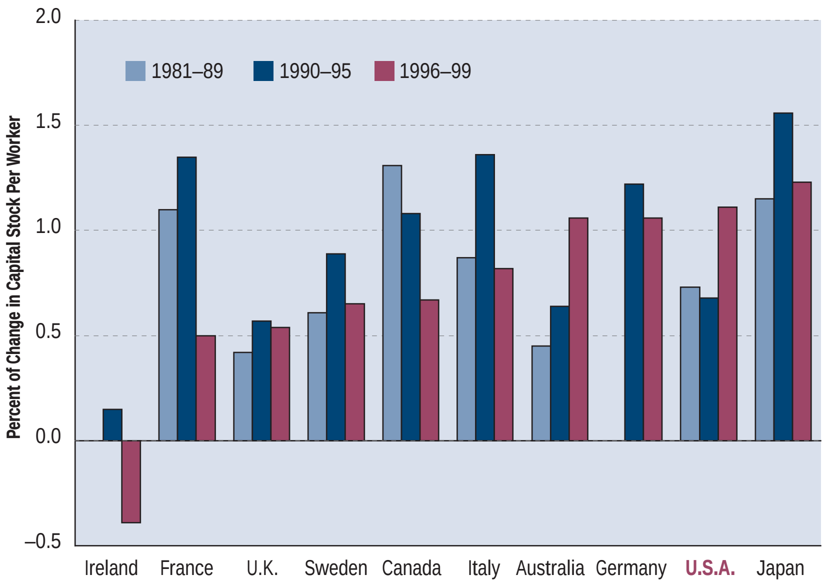


Source: U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov.

CHART 1.9

Growth in U.S. Capital Stock Per Worker Surged after 1995

Percent of Change in Capital Stock Per Worker



Source: Gust, Christopher and Jaime Marquez, "Productivity Developments Abroad," *Federal Reserve Bulletin*, October 2000.

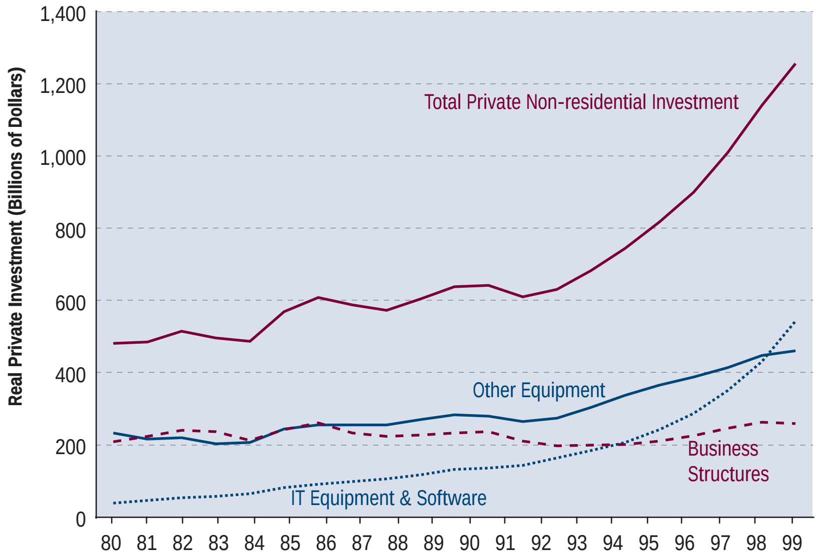
Investment in Information Technology Fueled Much of the Rise in Capital Stock

The fastest growing component of capital investment was in information processing equipment and software. Real private investment in IT equipment and software increased nearly six-fold from $91 billion in 1985 to over $542 billion in 1999. Investment in IT, as a share of total private non-residential investment, increased from less than 10% in 1980 to over 43% in 1999.

CHART 1.10

Information Technology Was a Key Factor in Investment Growth

Real Private Non-residential Investment, Billions of 1996 Dollars

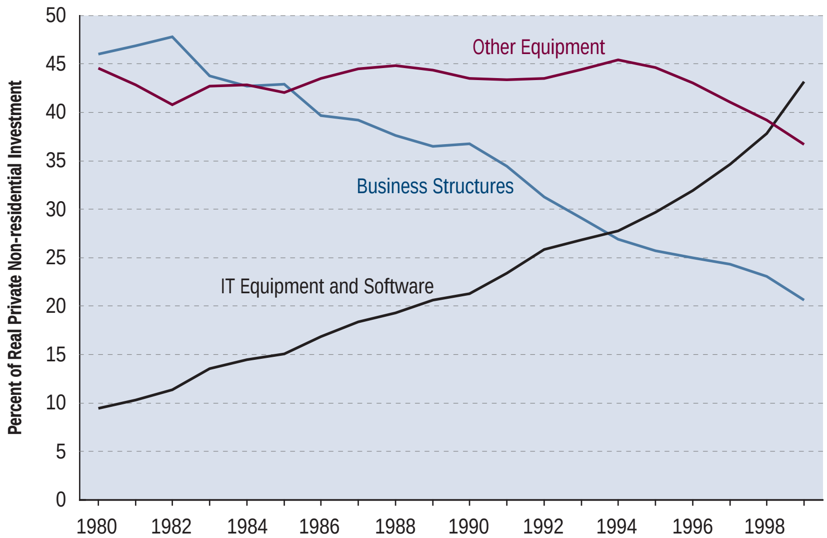


Source: U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov.

CHART 1.11

Information Technology Accounted for Nearly Half of Business Investment

Percent of Real Private Non-residential Investment



Source: U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov.

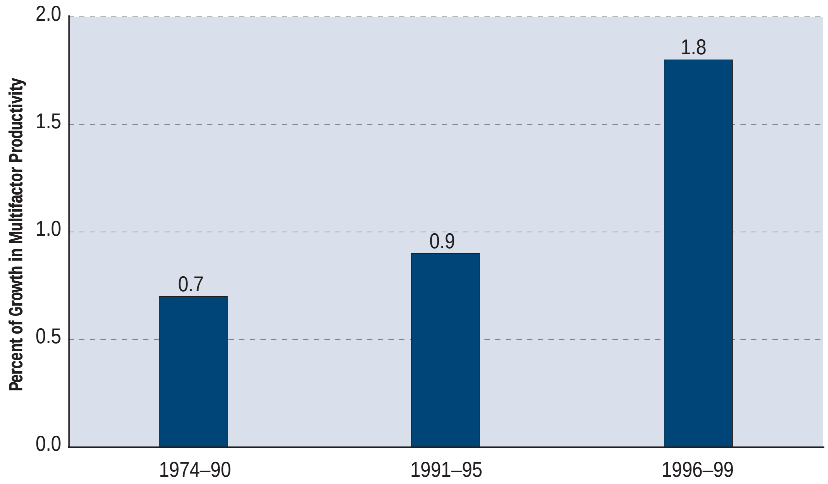
Productivity Growth Hit a 25 Year High

A burst of productivity growth in the mid-1990s contributed decisively to overall U.S. economic performance. Productivity growth had been lackluster in the 1980s and early 1990s, but the United States surged ahead of other industrial economies after 1995. High productivity growth made it possible for the United States to achieve full employment without triggering inflationary pressures.

CHART 1.12

Productivity Fueled Economic Growth without Inflation

Percent of Growth in Multifactor Productivity

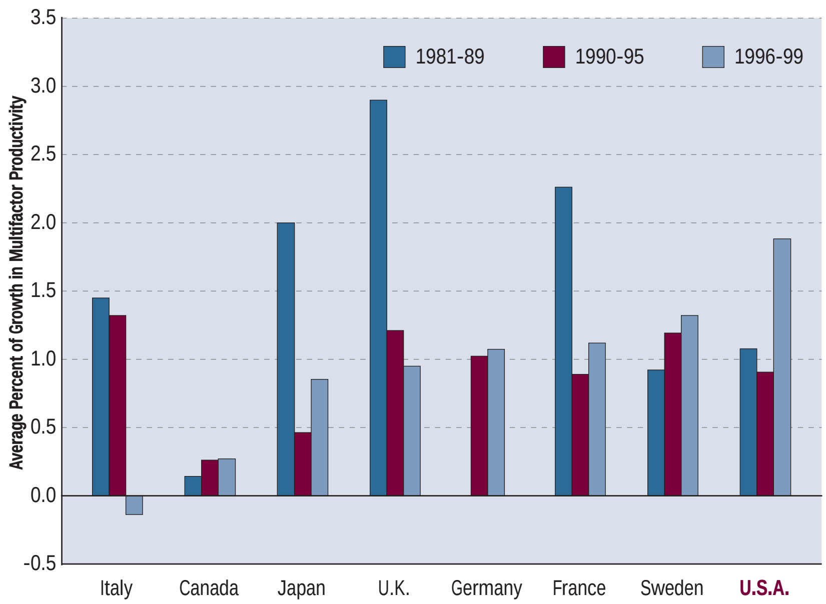


Source: Council Calculations.

CHART 1.13

U.S. Productivity Growth Surged Ahead of Most Other Industrial Economies after 1995

Average Percent Growth in Multifactor Productivity



Source: Gust, Christopher and Jaime Marquez, "Productivity Developments Abroad," *Federal Reserve Bulletin*, October 2000.

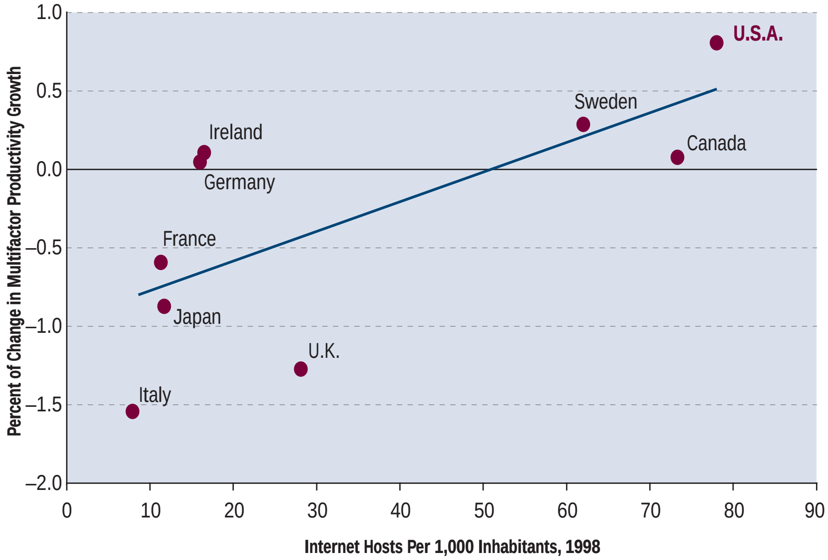
Information Technology Played a Key Role in Productivity Growth

Countries with higher IT usage experienced higher productivity growth. The differential from this source of productivity growth can be expected to narrow, however, as the rest of the world catches up to the early U.S. lead in IT investment. (See Section III.)

CHART 1.14

Higher IT Usage Correlated with Higher Productivity Growth

Percent Change in Multifactor Productivity Growth (using average growth rates in 1981–95 and 1996–98) and Number of Internet Hosts, 1998



Source: Gust, Christopher and Jaime Marquez, "Productivity Developments Abroad," *Federal Reserve Bulletin*, October 2000.

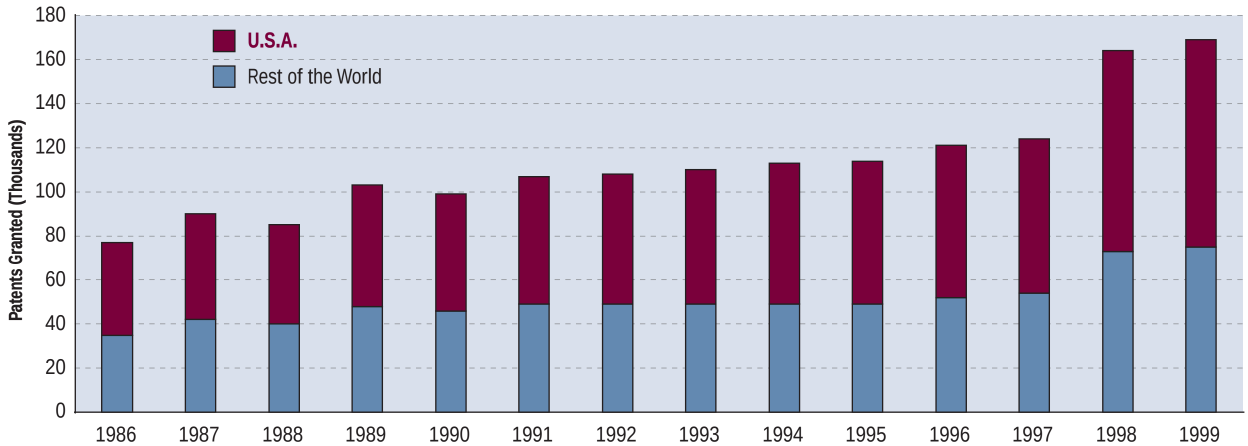
High Rates of Innovation Expanded Investment Opportunities

The rapid pace of innovation in the United States created investment opportunities in new technologies, new products and new businesses. One indicator of innovation is patenting. U.S. patenting rates exceeded most other industrialized countries, a result of historically strong R&D investment and technological leadership. In the 1990s, however, investment in frontier research lagged. (See Section II.)

CHART 1.15

The U.S. Led the World in Patenting

Total Patents Granted, 1986-99

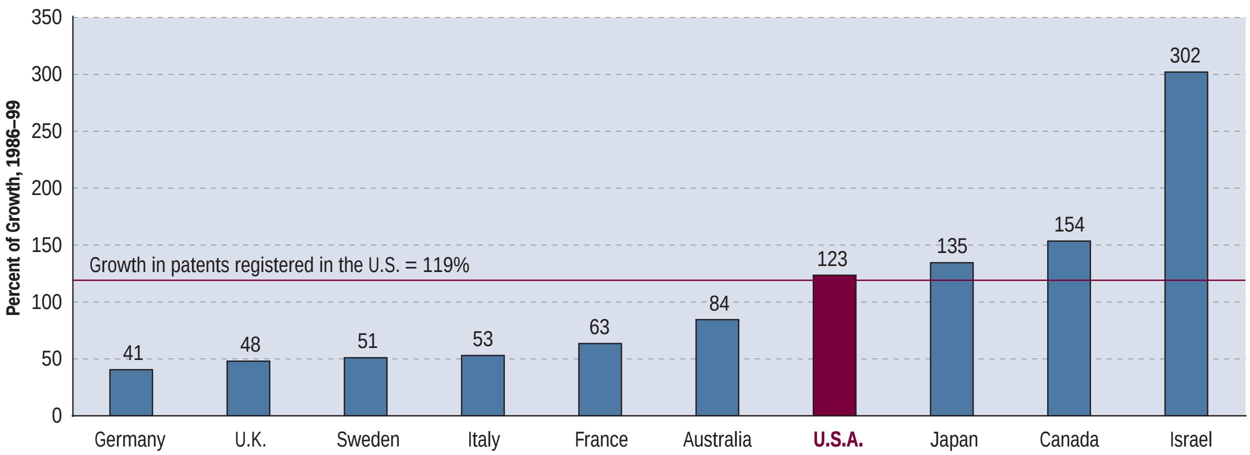


Source: U.S. Patent and Trademark Office, www.uspto.gov.

CHART 1.16

The Growth in U.S. Patenting Outpaced Most Industrialized Countries

Percent Growth in Patents Granted in the U.S., 1986–99



Source: U.S. Patent and Trademark Office, www.uspto.gov.

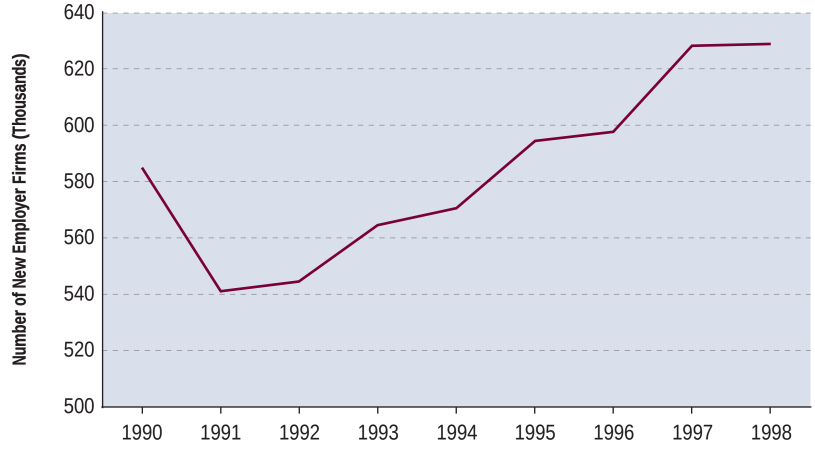
Entrepreneurial Activity Put Innovation to Work—Boosting Both Investment and Job Creation

A dynamic entrepreneurial culture in the United States created millions of new firms and new jobs. Nearly 5.3 million new firms were launched between 1990 and 1998, mainly high-technology companies and small service firms. New firms accounted for one-third of the 10 million new jobs created between 1990 and 1997 and were one of the drivers of growth in capital investment.

CHART 1.17

Entrepreneurs Launched Hundreds of Thousands of New Firms Annually

Numbers of New Employer Firms Launched, 1990–98

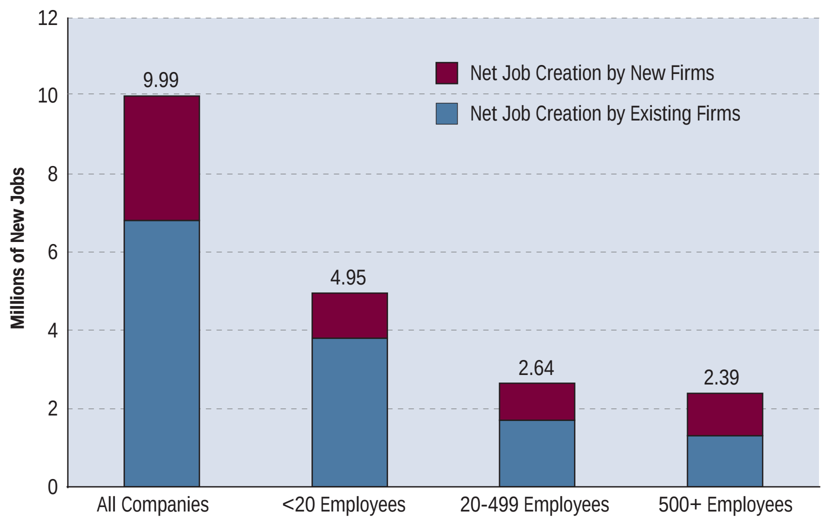


Source: U.S. Department of Labor, Bureau of Labor Statistics, www.bls.gov.

CHART 1.18

New Firms Created One-Third of Net New Jobs

Net New Jobs Created by Firm Size, 1990-97, Millions



Source: U.S. Small Business Administration, http://www.sba.gov/advo/stats/int_data.html.

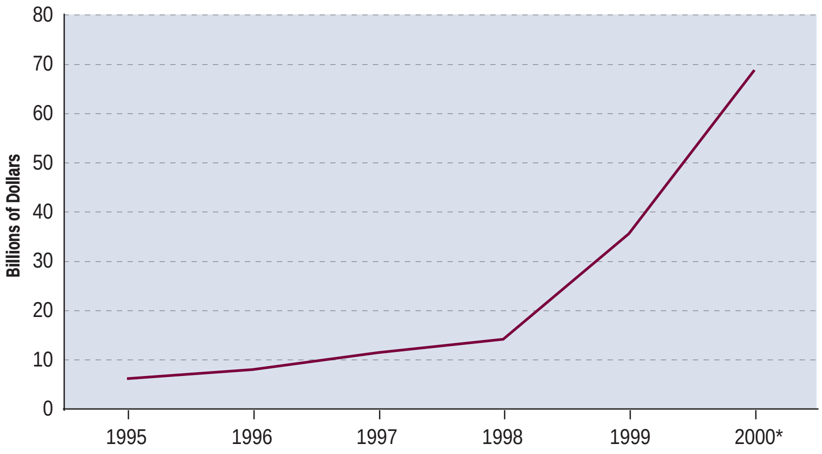
Abundant Risk Capital Supported New Company Growth

An increasing amount of capital went toward commercializing innovative technologies, products and services. Institutional venture capital (VC) investments increased nearly six-fold between 1995 and 2000. Formal VC investments were matched, and perhaps even exceeded, by investments from wealthy private investors (angel capital). Although there is little data on angel capital, a 1998 estimate put annual angel investment at $20 billion versus a little over $14 billion in venture capital.[1] Another source of capital for entrepreneurial activity was the increase in the IPO market, which went from just over $4 billion in 1990 to over $55 billion in 2000.

CHART 1.19

Venture Capital Increased Six-fold in Only 5 Years

Venture Capital Investments in the United States, Billions of Dollars



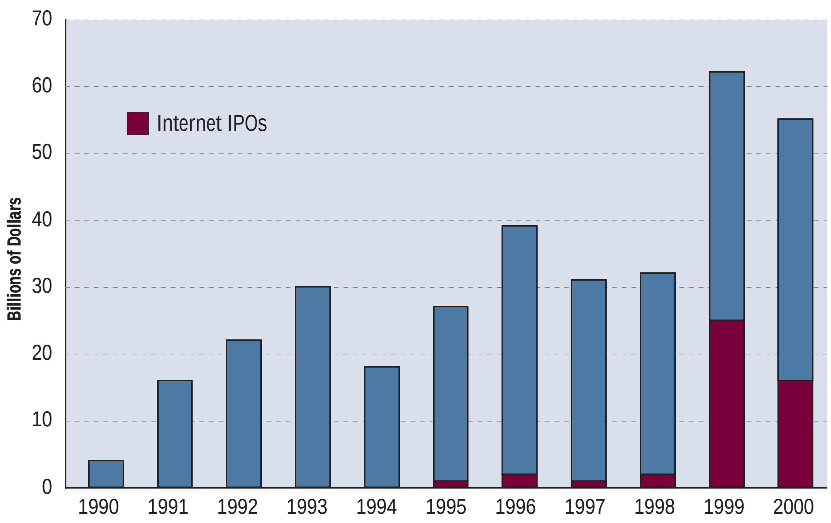
*annualized rate

Source: PricewaterhouseCoopers LLP, *MoneyTree Survey*, www.pwcglobal.com.

CHART 1.20

Equity Markets Financed New Company Growth

Total Value of U.S. Initial Public Offerings and Internet IPOs, Billions of Dollars



Source: Hale & Dorr, www.haledorr.com.

[1]National Commission on Entrepreneurship Newsletter, 2/29/00.

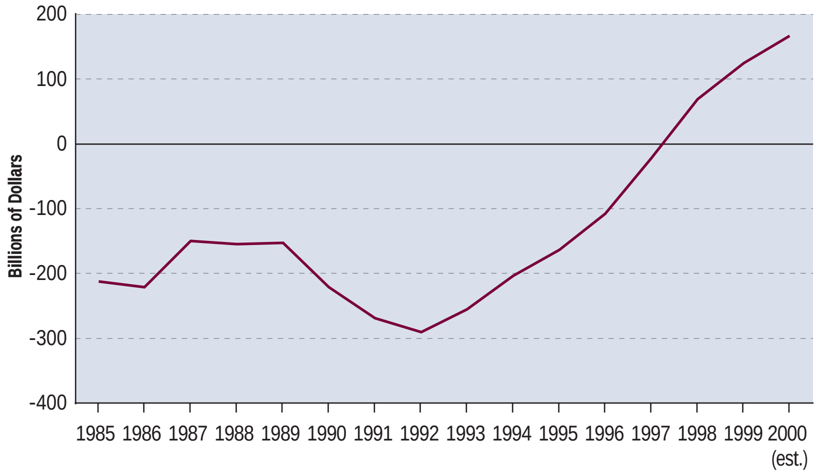
Fiscal Discipline Freed Up Capital for Private Investment

The decline in federal borrowing freed up capital for private investment and lowered the cost of capital. The government surplus helped to keep the national savings rate relatively stable, offsetting a sharp decline in the personal savings rate. (See Section II.) The U.S. government was notably more successful than Europe and especially Japan in restoring fiscal balance.

CHART 1.21

Government Surplus Freed Private Capital for Investment

Federal Government Surplus or Deficit, Billions of Dollars

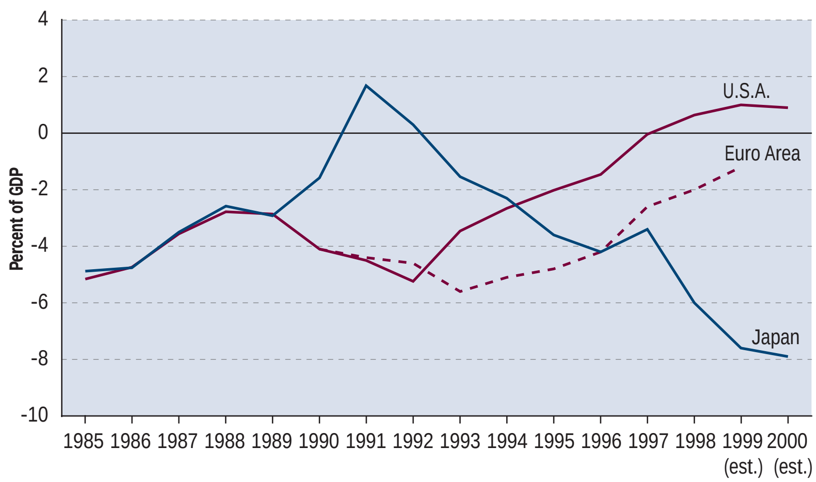


Source: U.S. Department of Commerce, Bureau of Economic Analysis, and Council of Economic Advisors, *Economic Report of the President,* February 2000. p. 397, Table B-75.

CHART 1.22

The U.S. Was More Successful in Restoring Fiscal Balance Than Europe or Japan

Surplus/Deficit as a Percent of GDP



Sources: International Monetary Fund *International Financial Statistics Yearbook.* Japanese Ministry of Finance. World Bank 1999 *World Development Indicators.* U.S. Department of Commerce, Bureau of Economic Analysis and Council of Economic Advisors.

U.S. Global Market Opportunities Expanded

U.S. economic resurgence coincided with increasing globalization of markets. Trade liberalization helped to create a three-fold increase in the volume of world trade after 1985. Although the U.S. trade imbalance persisted and widened (see Section II), the United States was able to expand its share of a much larger global market. U.S. trade performance highlighted competitive advantages in services, R&D-intensive products and licensing of intellectual property.

CHART 1.23

U.S. Exports Kept Pace with Rapidly Growing Global Trade

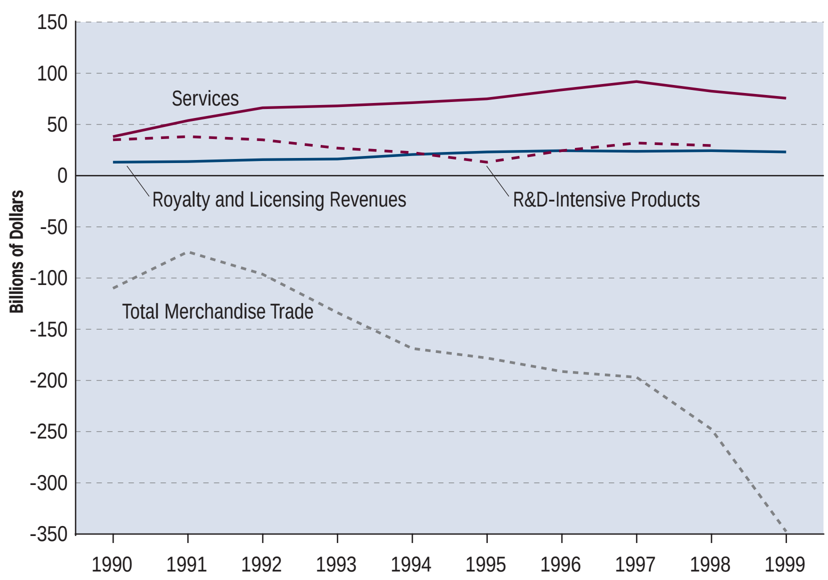
Growth in Exports 1985–99, Billions of U.S. Dollars

Source: International Monetary Fund, www.haverselect.com.

CHART 1.24

U.S. Trade Performance Highlighted Strengths in Services, High-Technology Products and Intellectual Property

Trade Balances in Services, R&D-Intensive Products, Licensing Revenues and All Other Goods, Billions of Dollars



Sources: National Science Foundation, *Science & Engineering Indicators 2000* CD-ROM. U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov.

SECTION 2

Underlying National Vulnerabilities: Where Economic Performance Fell Short

The economic boom masked areas of weakness that have the potential to undermine long-term U.S. economic performance. Despite overall prosperity, 40% of American households lost ground during the economic boom. Income inequality was higher in the United States than in any major industrialized country. Lack of basic skills and education prevented many workers from participating in the higher-wage jobs in the economy. A decrease in the national commitment to frontier research, an imbalance in the research portfolio, and declining numbers of graduates in key science and engineering fields put at risk the nation's future innovation capability. A declining savings rate failed to meet the economy's investment needs, creating a growing dependence on foreign capital. The U.S. current account deficit reached record levels.

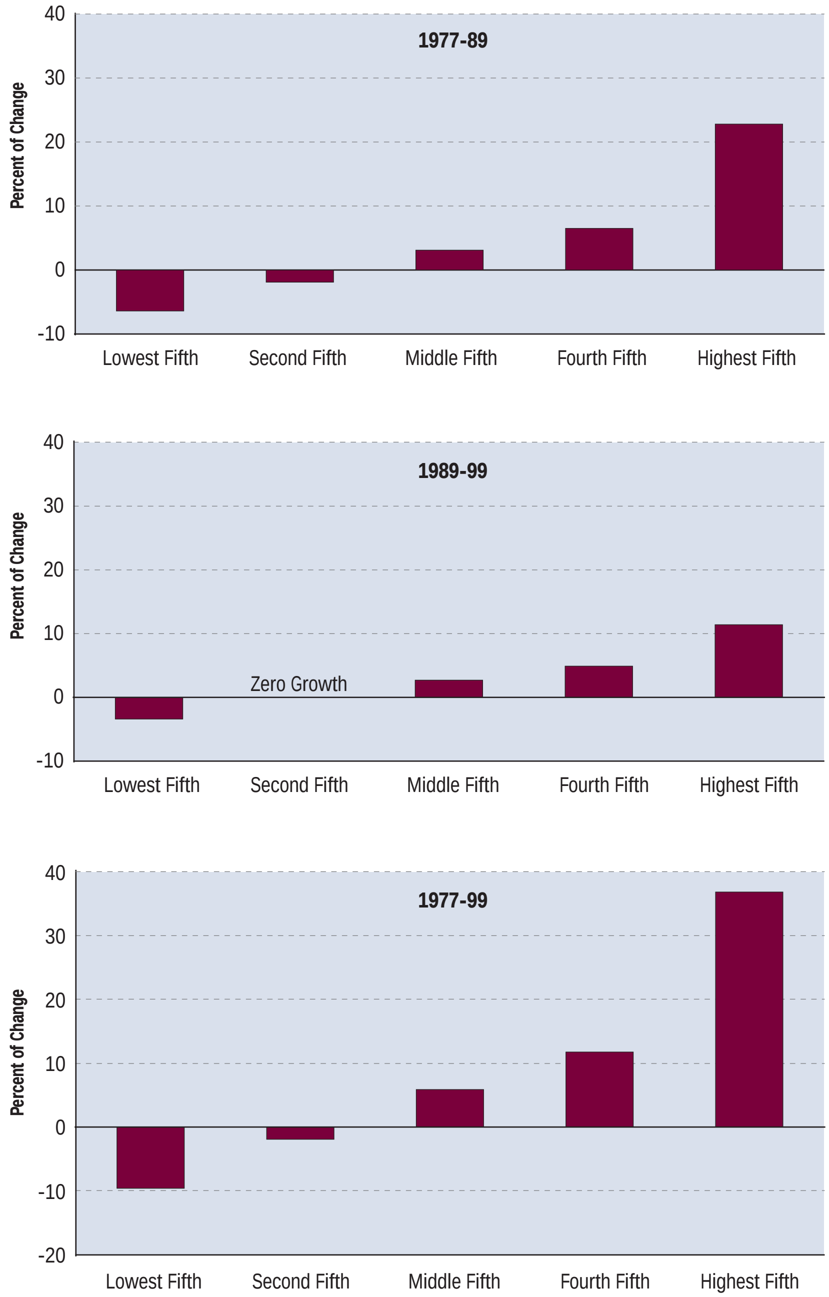
Many Americans Did Not Share in the Economic Boom

Inflation-adjusted incomes for the bottom 40% of American households actually declined over the last two decades. From 1977 to 1989, low-income households lost ground rapidly. Between 1989 and 1999, the decline in real household income continued, but more slowly. In 1998, there was evidence of a turnaround—with growth in real income for the bottom 40% for the first time in two decades. But, the upturn was not enough to offset an overall decline for low-income households. This assymetry highlights underlying skills and educational shortfalls among the workforce. It is troubling not only from a social equity perspective, but for its long-term implications for productivity and economic growth.

CHARTS 2.1–2.3

Many Households Did Not Benefit from the Economic Boom

Growth in Pre-tax Household Incomes, Including Market Incomes, Adjusted for Family Size, 1995 Dollars



Source: Bernstein, Jared, Lawrence Mishel and Chauna Brocht, *Any Way You Cut It*, Economic Policy Institute Briefing Paper, based on Congressional Budget Office data, September 2000.

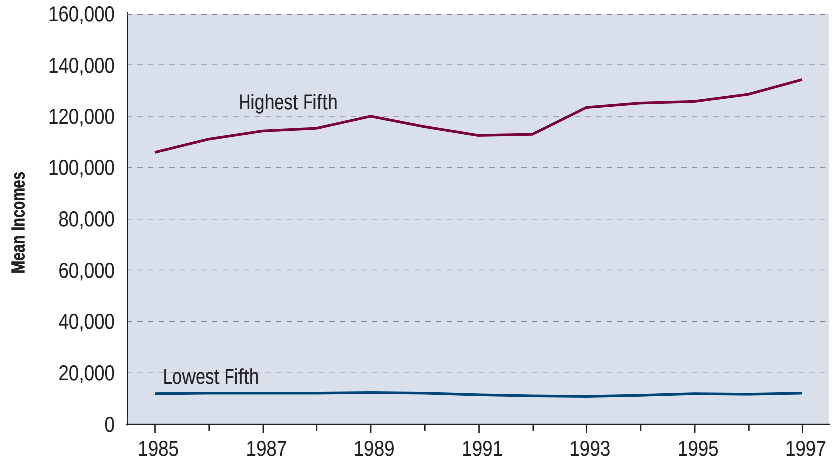
Income Disparities Widened

The gap between households at the top and bottom of the income ladder continued to widen—and remained higher in the United States than in any other industrialized country. A number of factors contributed to growing income inequality. Rapid technological change put a premium on higher education and more skills. The globalization of production put lower-skilled Americans in direct competition with abundant—and less expensive—sources of low-skilled workers worldwide.

CHART 2.4

Inequality in U.S. Income Widened

Comparison between Mean Income Levels of Households in the Lowest and Highest Quintiles, 1997 Dollars



Source: Economic Policy Institute, Datazone database, www.epinet.org/datazone.

CHART 2.5

Income Inequality in the United States Exceeded Other Industrial Economies

GINI Coefficient of Income Inequality, 1997 or Latest Year Available*

* The GINI coefficient measures the degree of income inequality. The coefficient can range from 0 (perfect equality with all families receiving the same income) to 1 (perfect inequality with only one family receiving all the income).

Source: World Bank, *World Development Indicators 2000* CD-ROM.

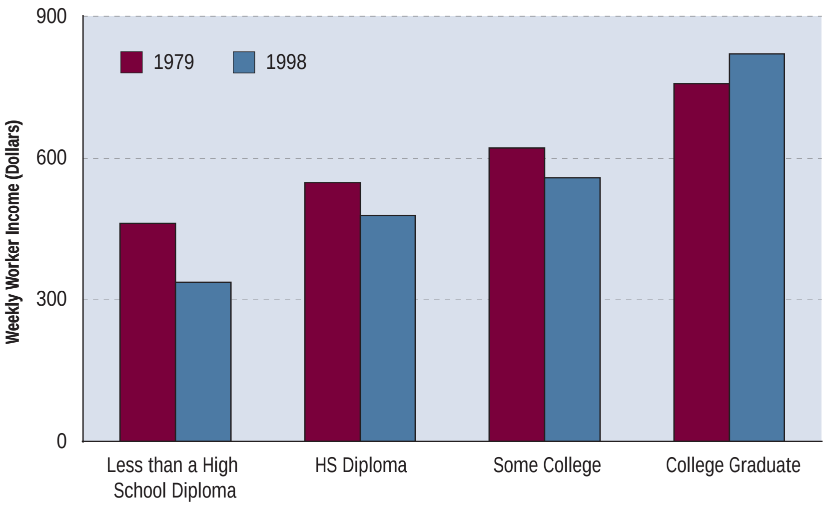
Lower Incomes Were Strongly Correlated with Lower Educational Attainment

There is a significant and widening income gap between workers with higher levels of education and those with less education. In 1979, the average college graduate earned 38% more than a high school graduate. By 1998, the disparity nearly doubled to 71%. Real weekly earnings for workers with less than a high school diploma fell from $462 in 1979 to $337 in 1998.

CHART 2.6

Wage Disparities Grew by Level of Education

Weekly Earnings for Workers 25 and Older, by Level of Education, 1998 Dollars



Source: U.S. Department of Labor, www.dol.gov/dol/asp/public/futurework/conference/nalsfina/nalsfina.htm

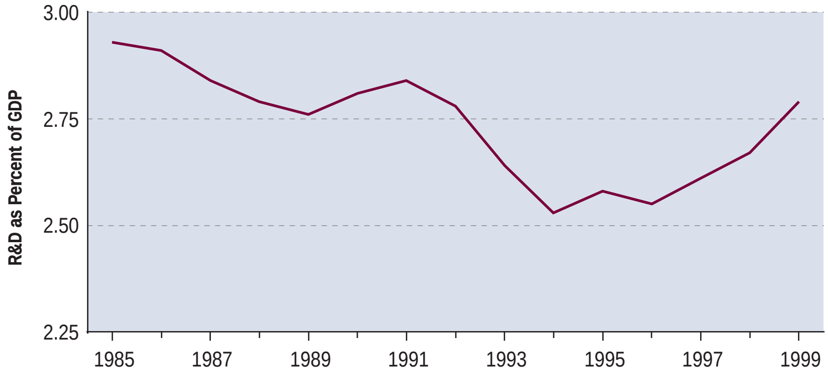
National Investment in R&D Lagged

Investment in knowledge creation and innovation is critical to prosperity in an advanced economy. Although the United States spends more in absolute terms than any G-7 economy, its share of national resources committed to research and development is lower today than it was 15 years ago. Although R&D investment trended upward in the late 1990s, the rate of growth in R&D investment during this economic boom lagged well behind R&D growth rates in previous expansion periods.

CHART 2.7

The Share of National Resources Committed to R&D Was Lower in 1999 Than in 1985

U.S. R&D as a Percent of GDP

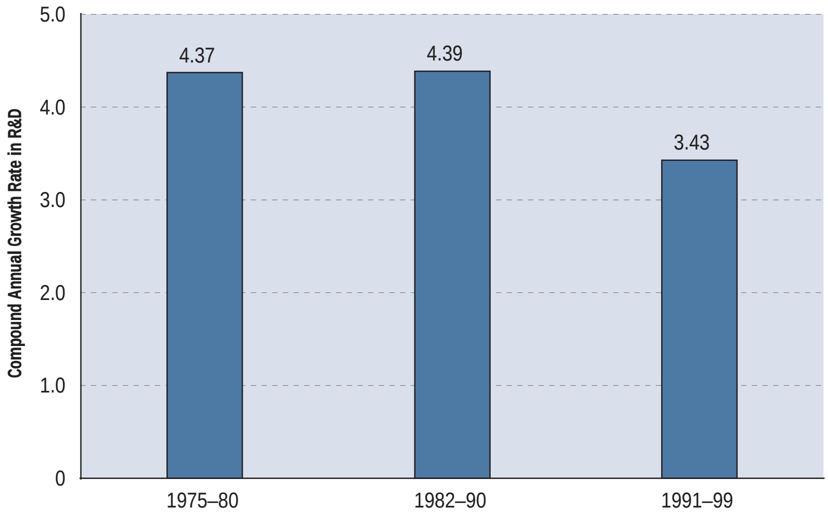


Source: National Science Foundation, *Science & Engineering Indicators 2000* CD-ROM.

CHART 2.8

The Growth in R&D Investment Was Lower during This Economic Boom Than in Previous Expansion Periods

Compound Annual Growth Rate in R&D during Economic Expansion Periods, 1992 Dollars



Source: National Science Foundation, *Science & Engineering Indicators 2000* CD-ROM.

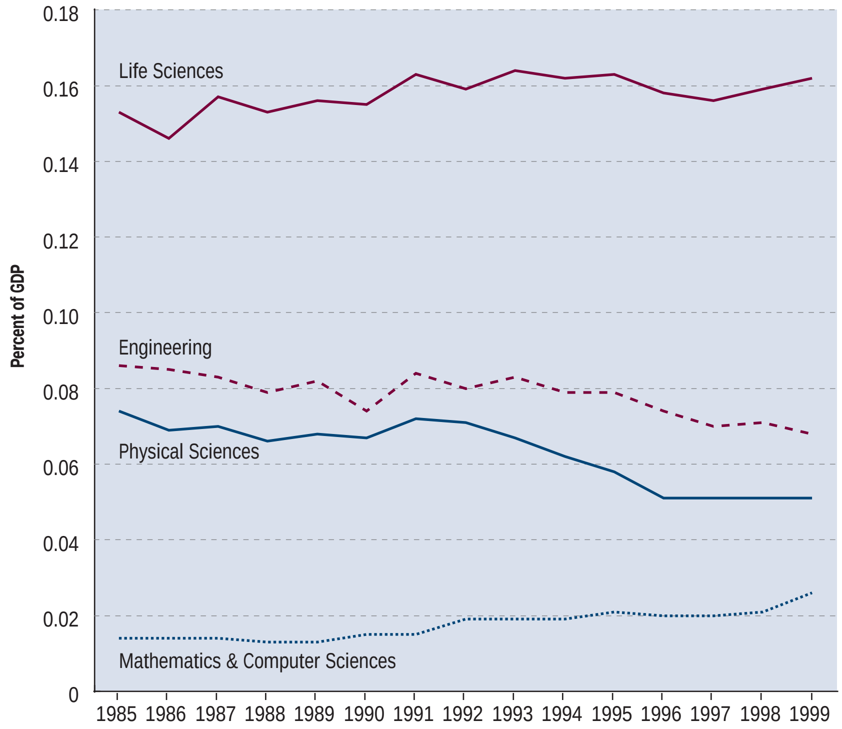
Outside of Life Sciences, Support for Important Research Disciplines Declined

The national goal of leadership, or being among the leaders, in every major research discipline is threatened by the uneven support for research among the major disciplines. With the decline in defense R&D spending, engineering and the physical sciences received a declining or static share of federal basic and applied research funds. Computer sciences and math spending grew modestly. These neglected disciplines are precisely those that underpin future advances in IT, next-generation Internet and communications technologies, and the life sciences.

CHART 2.9

Support for Engineering and the Physical Sciences Lagged

Federal Basic & Applied Research Investments by Discipline as a Percent of GDP, 1992 Dollars



Source: National Science Foundation, *Science & Engineering Indicators 2000* CD-ROM.

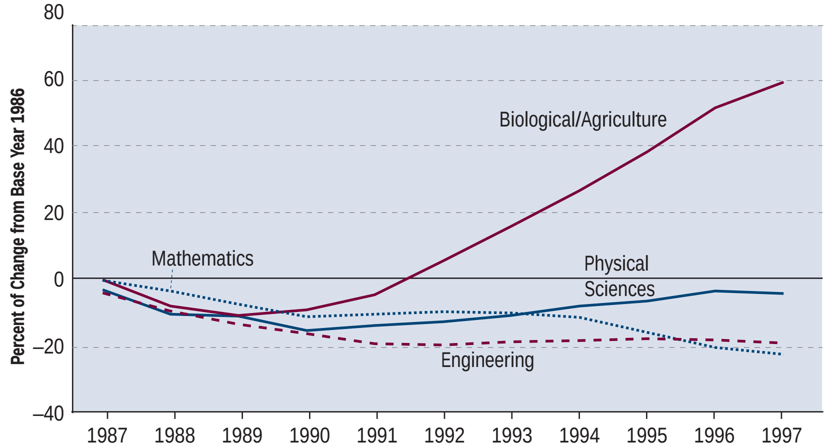
The Number of College and Advanced Degrees in Science and Engineering Was Flat or Declining

An innovation-driven economy depends on a growing cadre of scientists and engineers. With the exception of the life sciences, however, the trend lines were in the opposite direction, even though demand for technically-trained talent was rising. Undergraduate degrees in engineering, the physical sciences, and math and computer sciences were static or declining. Graduate degrees in these disciplines followed a similar pattern. (See Section IV.) Outside the United States, in contrast, the share of science and engineering degrees was increasing.

CHART 2.10

Outside of Life Sciences, Undergraduate Degrees in Science and Engineering Were Flat or Declining

Growth in Science and Engineering Degrees, Indexed to 1986

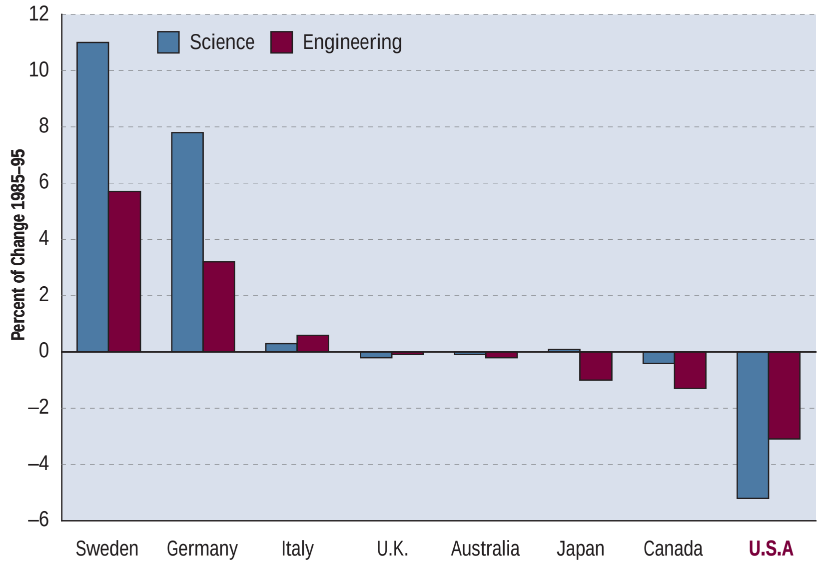


Source: National Science Foundation, WebCASPAR database, www.nsf.gov.

CHART 2.11

The Proportion of Science and Engineering Degrees Grew Abroad While Declining in the United States

Change in Science and Engineering Degrees as a Percent of First University Degrees, 1985–95



Source: NCES, *International Education Indicators: A Time Series Perspective, 1985–95*, February 2000.

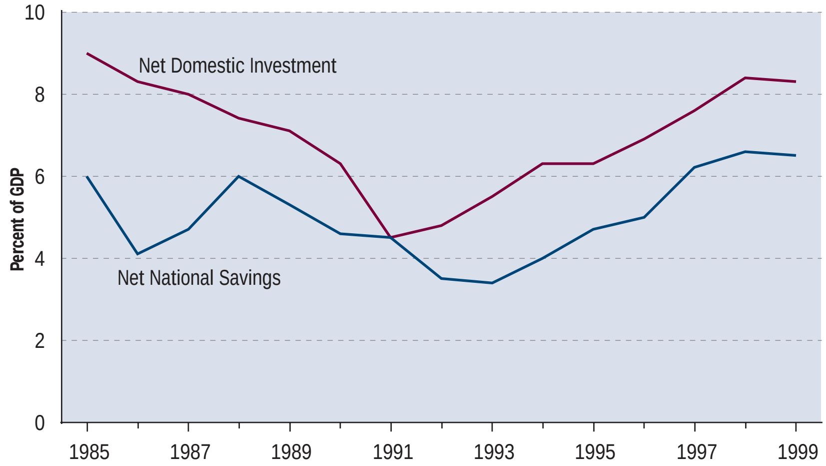
Domestic Savings Fell Short of Meeting U.S. Investment Needs

Over the last 15 years, net domestic investment generally was greater than net domestic savings. The difference was made up by inflows of foreign capital. Foreign capital accounted for nearly 20% of total U.S. investment in 1999, or about $313 billion. Low domestic savings rates contributed to the shortfall of domestic capital available for investment. This was partially offset by the relatively higher and stable U.S. rates of return on capital that attracted foreign investment. These inflows of foreign capital are by no means assured in the future.

CHART 2.12

The Gap between Savings and Investment Persisted

Net National Savings, Net Domestic Investment as a Percent of GDP

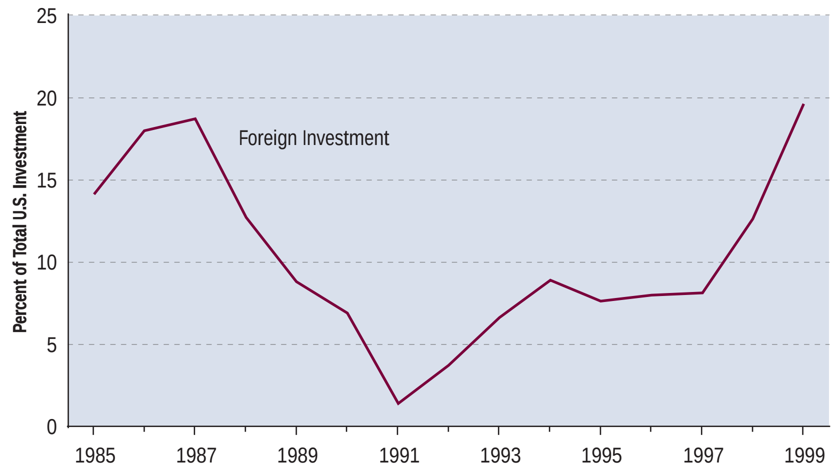


Source: U.S. Department of Commerce, Bureau of Economic Analysis, and Council of Economic Advisors, *Economic Report of the President*, February 2000. p. 72.

CHART 2.13

Foreign Capital Funded an Increasing Share of U.S. Domestic Investment

Foreign Investment as a Percent of Total Domestic Investment



Source: U.S. Department of Commerce, Bureau of Economic Analysis, and Council of Economic Advisors, *Economic Report of the President*, February 2000. p. 343, Table B-30.

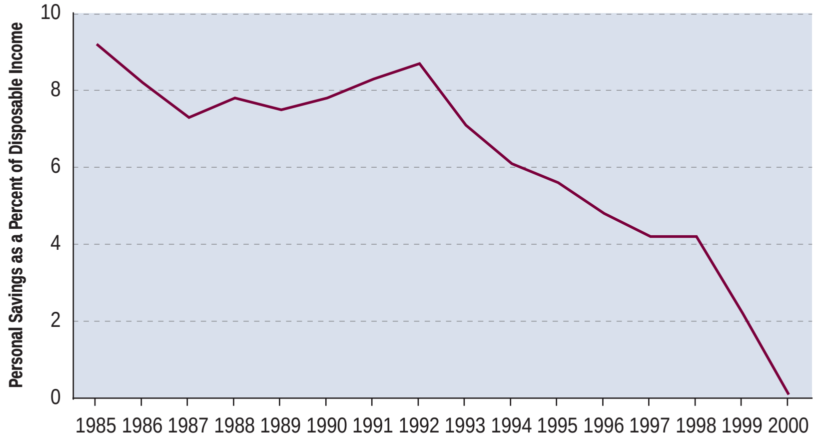
Personal Savings Rates Fell Sharply

Beginning in 1991, personal savings rates declined, falling to levels not seen since the Great Depression.[2] Although the government's budget surplus helped to offset the decline in personal savings, holding the national savings rate relatively constant, the U.S. national savings rate was low compared to both industrial and emerging economies. Raising the savings rate will be essential to expanding the amount of investment that can be funded domestically, with returns flowing to U.S. holders, rather than borrowed from abroad.

CHART 2.14

Personal Savings Rates Declined Sharply

Personal Savings as a Percent of Disposable Income

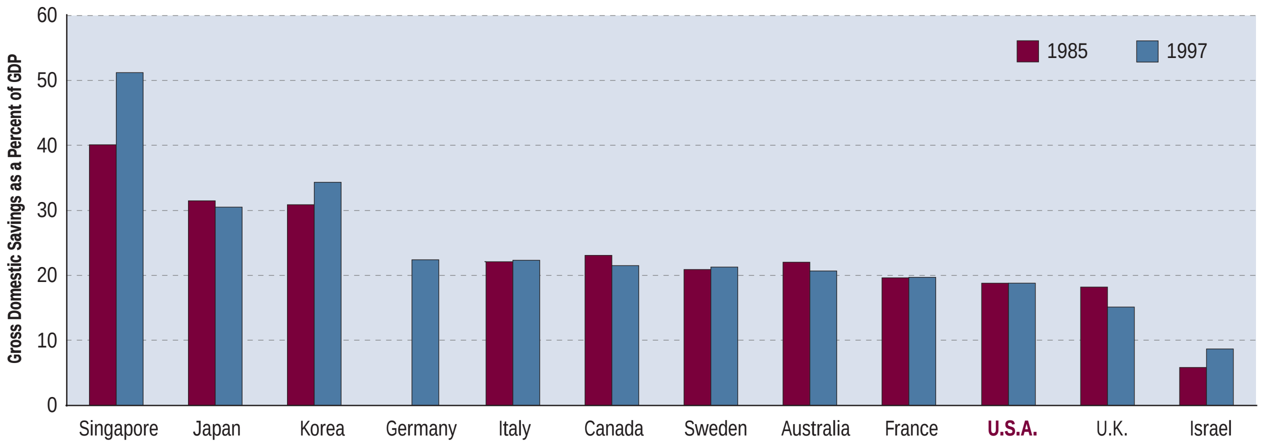


Source: U.S. Department of Commerce, Bureau of Economic Analysis, www. bea.doc.gov.

CHART 2.15

The U.S. Savings Rate Was Low Compared to Other Industrial Economies

Gross Domestic Savings as a Percent of GDP, 1985 and 1997 or Latest Year Available



Source: World Bank, *World Development Indicators 2000* CD-ROM.

[2] The Bureau of Economic Analysis (BEA) statistics omit a potentially important aspect of American savings. Financial and tangible assets (such as real estate), viewed by many Americans as principal vehicles for savings, are not included. However, even if net gains of financial and tangible assets were included, the personal savings rate would still show a secular decline.

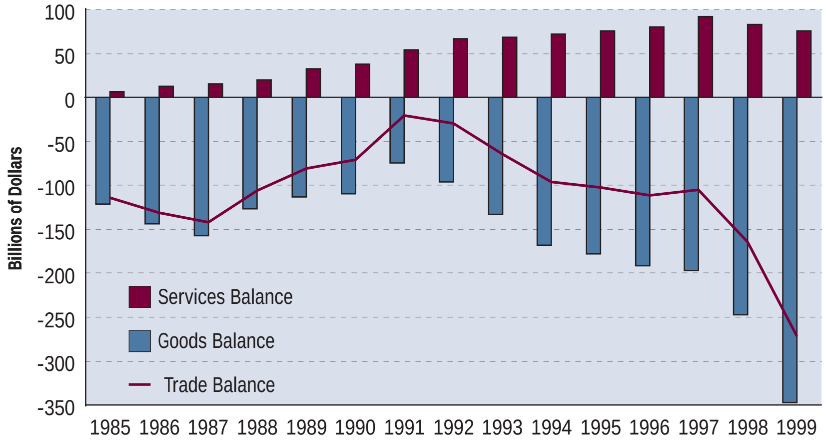
The Trade Deficit Persisted and Widened

The U.S. trade deficit, after narrowing considerably in the late 1980s and early 1990s, set record levels every year after 1995.[3] A robust domestic economy coupled with a slowdown of growth in international markets helped fuel the deficit, together with a strengthening dollar and a spike in oil prices. For much of the 1990s, the gap between imports and exports remained relatively constant. Toward the end of the decade, however, growth in demand for U.S. exports declined while U.S. consumption of imports spiked upward, widening the deficit.

CHART 2.16

The U.S. Trade Deficit Doubled

U.S. Trade Balance in Goods and Services, Billions of Dollars

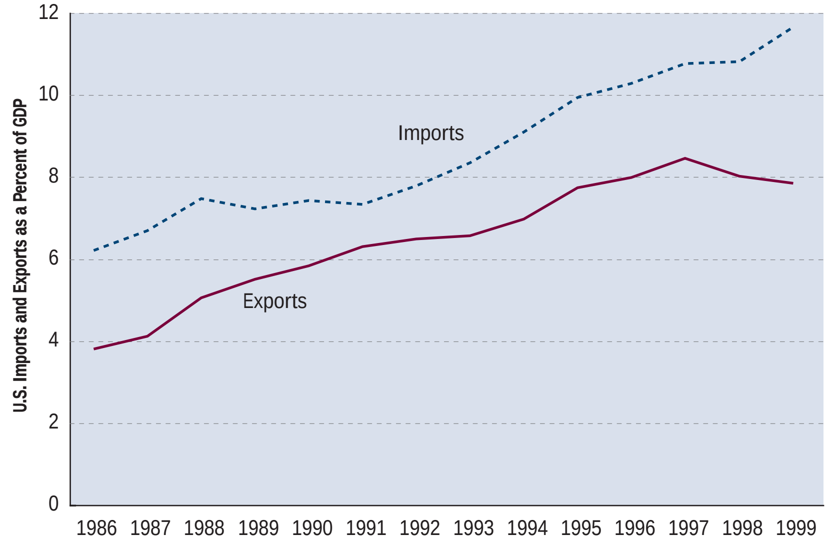


Source: U.S. Department of Commerce, Bureau of Economic Analysis and Council of Economic Advisors, *Economic Report of the President,* February 2000.

CHART 2.17

The Deficit Was Driven by Sharp Increases in Imports

U.S. Imports and Exports as a Percent of GDP



Source: U.S. Department of Commerce, Bureau of Economic Analysis, www.bea.doc.gov.

[3] Note that U.S. exports may be underestimated because of the difficulty in capturing software and service exports. Recent estimates put the possible undercount in the billions of dollars which would moderate the size of the deficit, but by no means eliminate it.

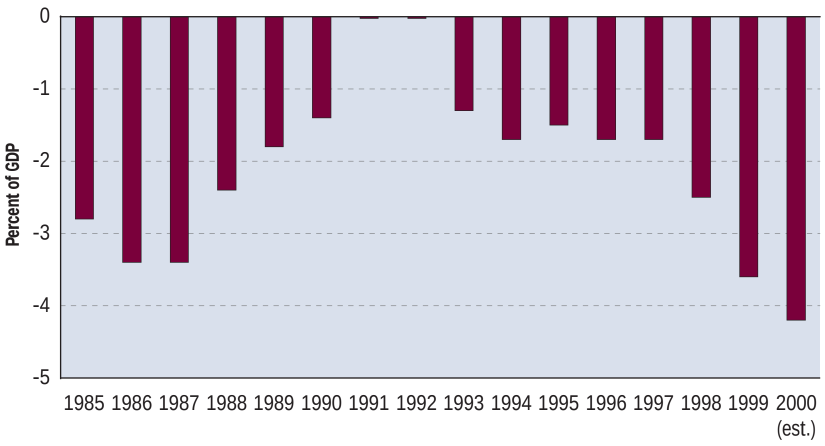
The Current Account Deficit Reached Record Levels

The current account deficit reached the uncharted territory of 4% of GDP in 2000.[4] A deficit of this scale reflects not just cyclical factors but a structural imbalance between savings and investment. This imbalance can only be corrected by raising the rate of national savings, lowering the rate of domestic investment, increasing exports or slowing the demand for imports.

CHART 2.18

The Current Account Deficit Exceeded 4% of GDP

U.S. Current Account Deficit as a Percent of GDP



Source: U.S. Department of Commerce, Bureau of Economic Analysis and Council of Economic Advisors, *Economic Report of the President*, February 2000.

[4] The current account is the sum of balances in trade (exports minus imports of goods and services), factor income (primarily investment income), and unilateral transfers.

SECTION 3

The Rising Bar for Global Competitiveness: Why U.S. Leadership Will Be Challenged

The bar for U.S. competitiveness is rising because the global capacity for innovation is increasing. All advanced economies — and some emerging ones—are moving into the space once dominated by the United States. Most nations are investing heavily in education and advanced skills. The number of scientists and engineers is increasing faster overseas than in the United States. Global R&D investments are rising—and generating increasing numbers of high-quality foreign patents and scientific articles. The U.S. first-mover advantage in information technology is diminishing as the rest of the world rapidly acquires the tools that powered U.S. productivity growth in the 1990s. Globalization enables companies to access talent, technology and capital resources virtually anywhere. As a result, the United States increasingly will have to compete to be the preferred location for the highly productive investments of foreign and even domestic firms.

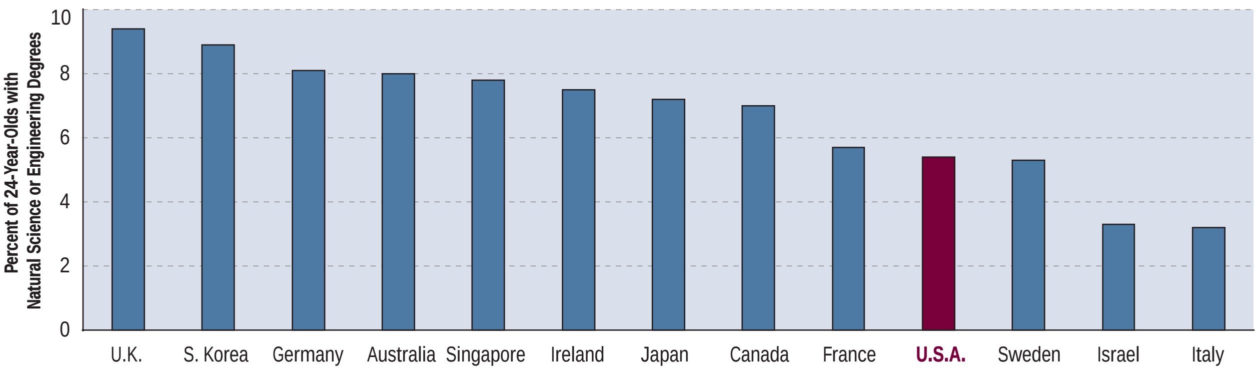
Other Countries Are Increasing Their Pools of Technical Talent Faster Than the United States

While science and engineering degrees are declining in the United States, they are increasing elsewhere. The availability of technical talent is critical in gauging future competitiveness. A well-educated and technically-trained workforce is essential to a nation's competitiveness in two key ways. First, it enables a country to shift more of its economic activity into higher technology and more productive activities that support higher wages. Second, an educated workforce is necessary to retain domestic investment and attract multinational investment. Robust increases in research talent highlight a growing commitment to boost innovation capacity and economic growth in other countries.

CHART 3.1

The Pool of Scientists and Engineers Is Increasing Rapidly in Other Countries

Ratio of Natural Science and Engineering Degrees to the 24-Year-Old Population, 1998 or Latest Year Available

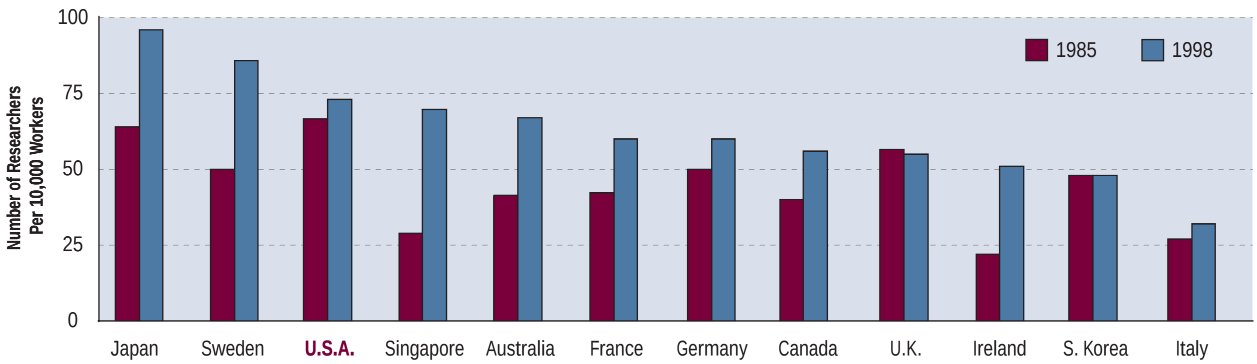


Source: National Science Foundation, *Science & Engineering Indicators 2000* CD-ROM.

CHART 3.2

Research Personnel Are a Growing Portion of the Workforce

Total Researchers Per Ten Thousand Workers



Source: Organization for Economic Cooperation and Development, *Science and Technology Indicators.*

Many Countries Are Gaining Access to Global Sources of Capital

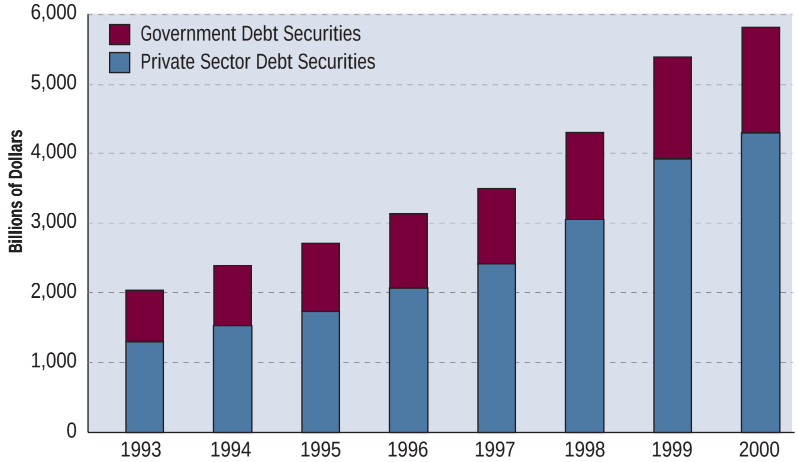
Access to capital is one of the basic requisites for enhancing competitiveness—and growing amounts of investment capital are available globally. For example, international debt issuance grew 190% between 1993 and 2000, from $2 trillion to nearly $5.8 trillion on a worldwide basis. The most notable trends over the period were a shift away from central government borrowing to private sector borrowing and the growing internationalization of the debt securities market. This translates into increasing amounts of capital available for foreign direct investment as well as locally financed investment through corporate debt issues.

The expansion in equity values, with more consumer participation internationally, is also increasing the availability of investment capital. Rising equity values make it easier for companies to raise funds for investment. Despite the sharp downturns in stock market capitalization, total world market capitalization increased an average of 283% between 1990 and 1999.

CHART 3.3

Global Access to Capital Is Growing

Outstanding Amounts of International Debt Securities

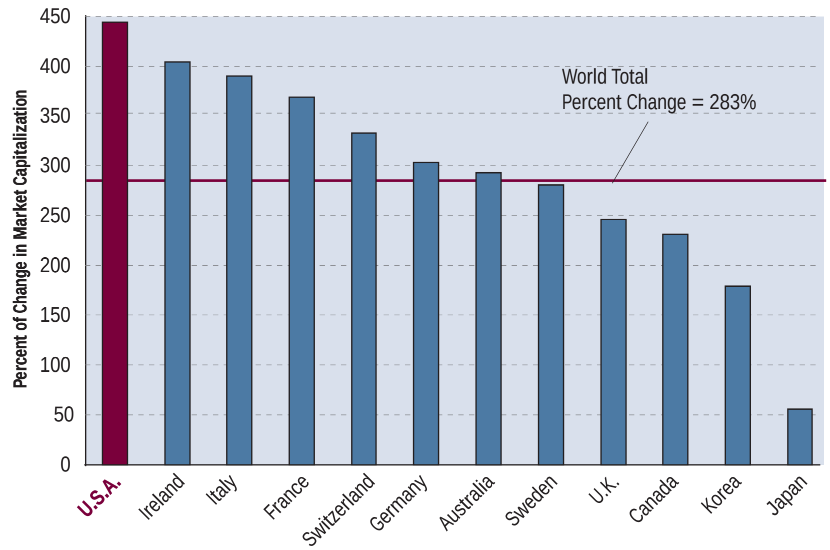


Source: Mathieson, Donald J. and Garry J. Schinasi, *International Capital Markets: Developments, Prospects, and Key Policy Issues,* International Monetary Fund, September 2000.

Chart 3.4

Growth in Global Equity Markets Increases Capital Availability

Percent Change in Market Capitalization, 1990–99



Source: Standard & Poor's 2000, *Emerging Stock Markets Factbook 2000.*

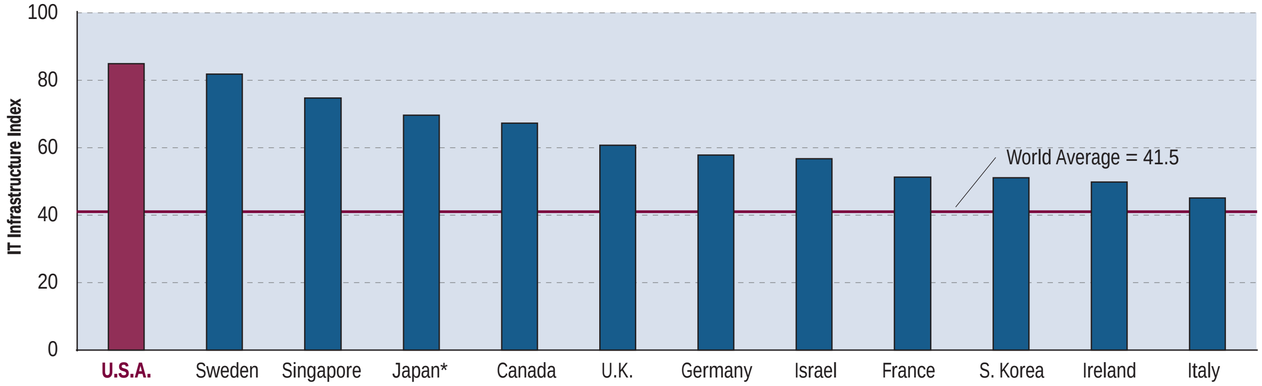
The Information Technologies That Powered U.S. Productivity Growth Are Being Deployed Globally

Information technology was an essential part of the U.S. economic expansion in the 1990s, but America's first-mover advantage is diminishing. Many countries are aggressively investing in information technologies. The sophistication of the information infrastructure in other countries—as measured by computer usage, Internet usage, telecommunications and educational attainment—is advancing so rapidly that many countries are converging on the U.S. lead. Computer utilization overseas, for example, is growing at triple-digit rates.

CHART 3.5

Growing Sophistication in Information Technologies Will Drive Global Productivity Growth

Info-structure (100=Highly Developed, 0=Undeveloped)



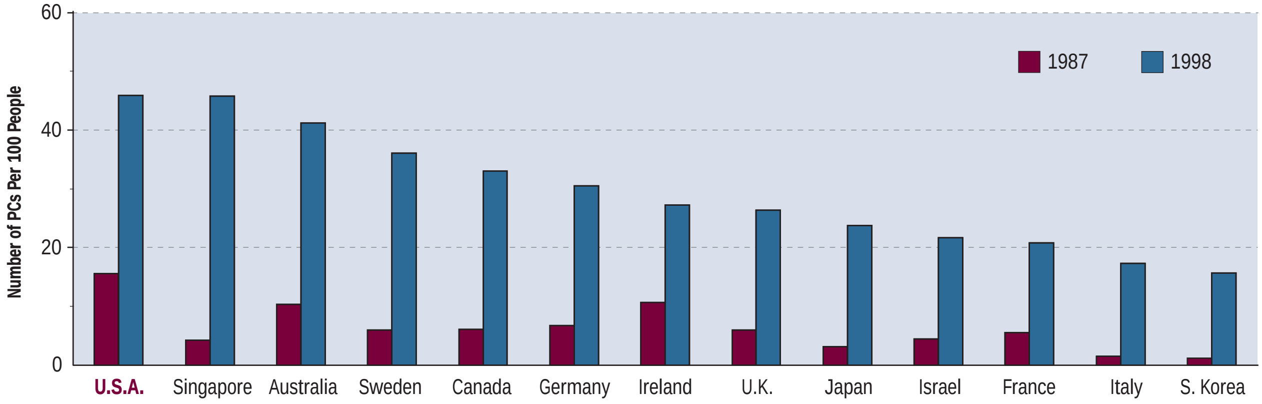
Source: Based on data from the International Data Corporation.

*Japan's relatively high score reflects its strong telecommunications sector and high literacy rather than strong computer and Internet growth rates.

CHART 3.6

Computer Utilization Is Rising Globally

PCs Per 100 People



Source: World Bank. *World Development Indicators 2000* CD-ROM.

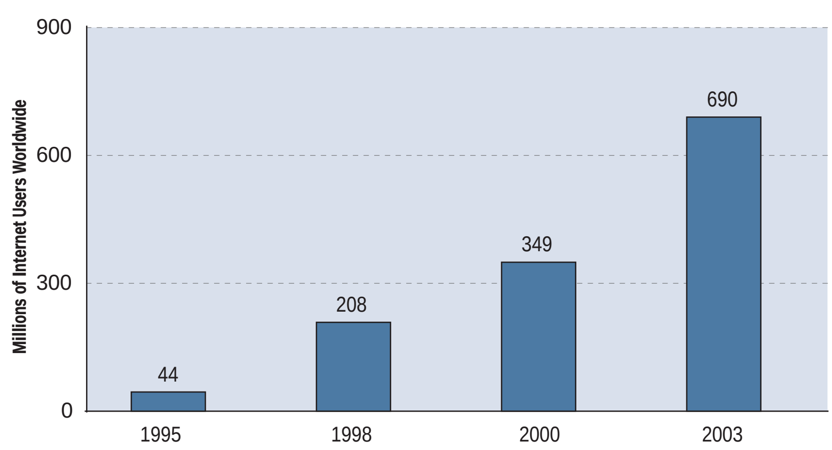
Internet Growth Will Be Faster Outside the United States

The number of Internet users worldwide is growing at a tremendous rate, from 44 million in 1995 to an estimated 690 million in 2003. Between 1995 and 2003, on average, over 221,000 new users will log on to the Internet *every day*. For the future, the fastest rates of growth will be outside the United States—and the power of networking will create tremendous economic efficiencies and new e-commerce opportunities overseas as well as in the United States.

CHART 3.7

Growth in Worldwide Internet Users Is Skyrocketing

Internet Users Worldwide

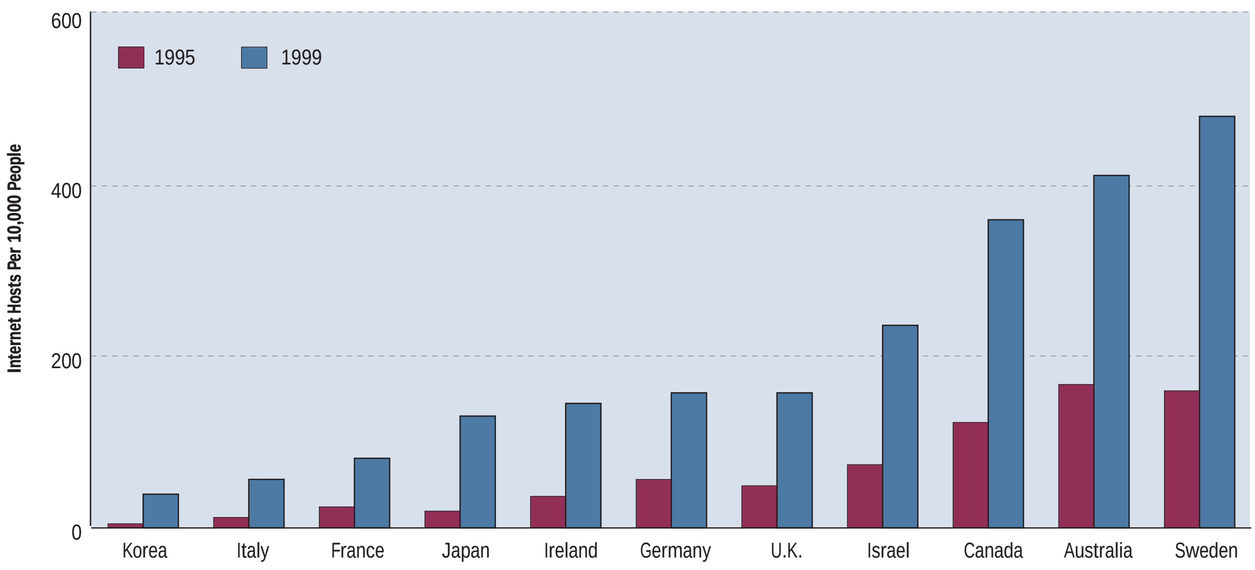


Source: International Data Corporation.

CHART 3.8

Internet Adoption Set a New Pace for Technology Diffusion

Internet Hosts Per 10,000 by Country



Source: Organization for Economic Cooperation and Development, *Science, Technology and Industry Outlook 2000.*

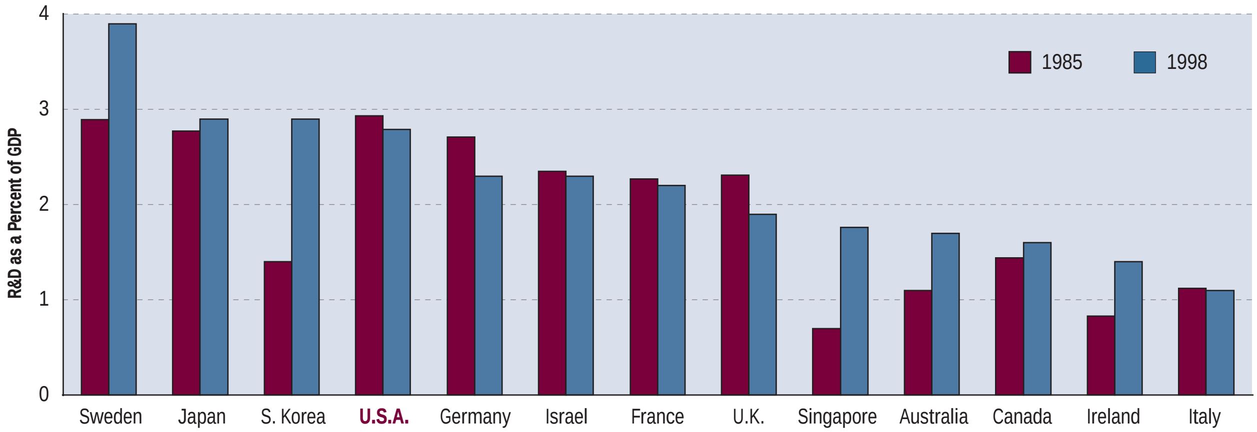
Global R&D Investment Is Expanding Rapidly

Many developed and developing nations are investing in research and development precisely because it enables them to develop new knowledge and exploit technologies more effectively. The growth rate in R&D expenditures overseas, particularly for some of the emerging economies, is very high. A number of the advanced industrial economies are also growing their R&D investments faster than the United States. Rising R&D investment by other countries is a measure of their growing emphasis on innovation capacity.

CHART 3.9

High National Investment in R&D Supports Innovation Capacity

R&D Intensity (Total R&D Investment as a Percent of GDP), 1985 and 1998 or Latest Year Available

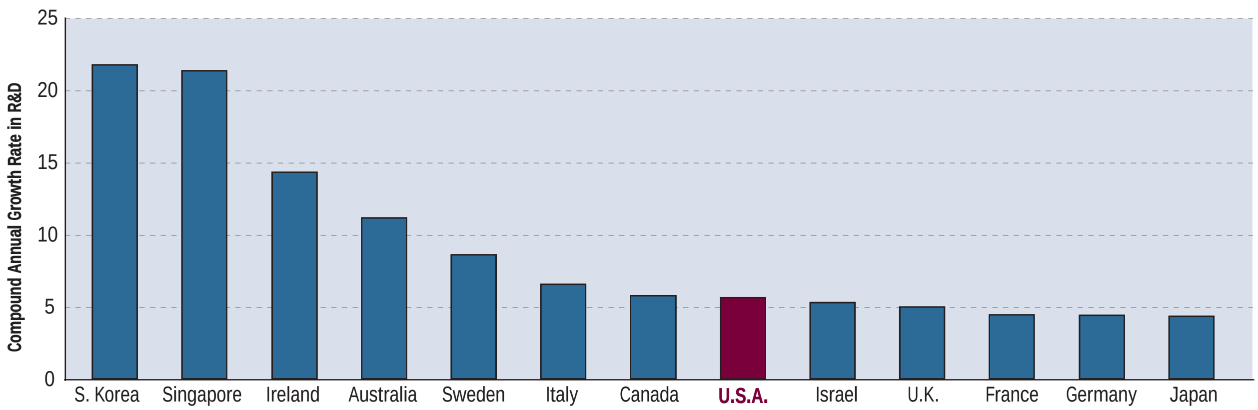


Source: National Science Foundation, *Science & Engineering Indicators 2000* CD-ROM.

CHART 3.10

Fast Growth in R&D Outside the United States Demonstrates a Commitment to Innovation

Compound Annual Growth Rate in R&D Expenditures, 1985–98 or Latest Year Available



Source: National Science Foundation, *Science & Engineering Indicators 2000* CD-ROM.

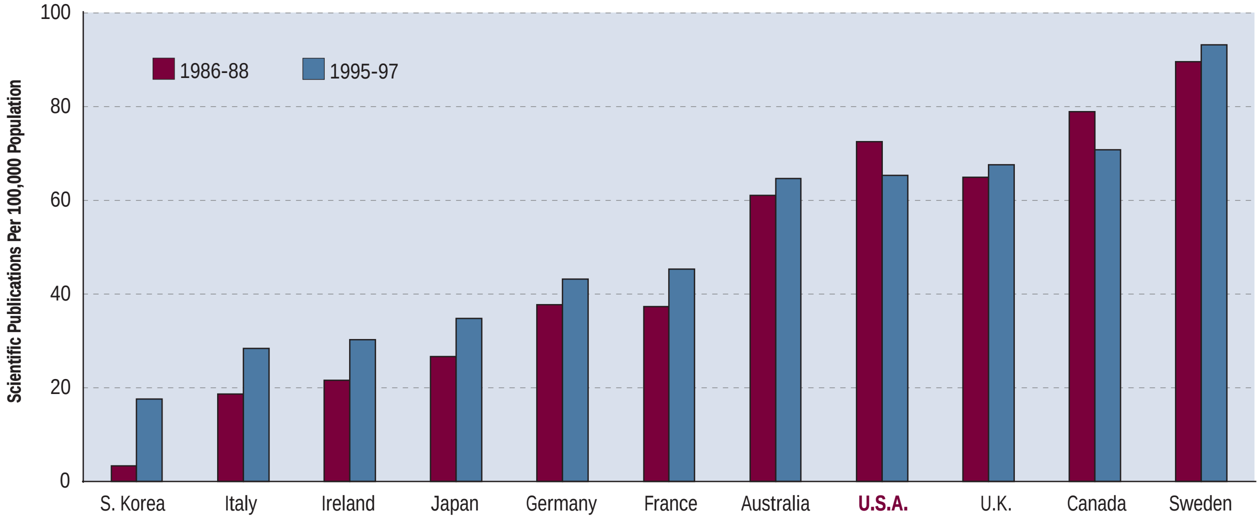
International Scientific Output Is Increasing

Innovative capacity can be measured by the number of articles published in peer-reviewed scientific publications. Although the United States has historically led the world in this area, the quality of scientific activity is increasing in many countries. Even as foreign scientific output increases, U.S. scientific and technical publication appears to be on a downward trajectory. This is perhaps a reflection of the slowdown in R&D investment in many disciplines.

CHART 3.11

Science Activity Is on the Rise Internationally

Number of Scientific and Technical Articles in Peer-Reviewed Publications Per 100,000 Population



Source: World Bank, *World Development Indicators 2000* CD-ROM.

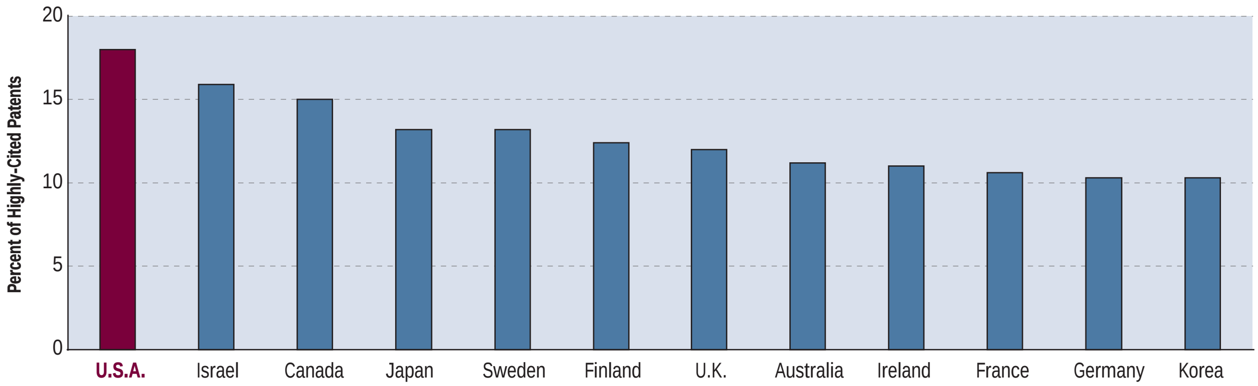
The Number of High-Quality Foreign Patents Is a Measure of Global Innovation Capabilities

Another measure of innovative capability is the quality of a country's patents. Quality can be measured by the number of times a patent is cited in subsequent patent applications—an indicator of its importance. Although the United States holds the largest share of highly-cited patents as a percent of total patents, a number of countries are converging on the U.S. position. Other innovator countries, including Israel, Canada, Japan and Sweden, are developing strong patent positions in key sectors, particularly IT and the life sciences.

CHART 3.12

Patent Quality by Foreign Inventors Is Strong

The Share of a Country's Patents Filed between 1994 and 1998 That Were Highly Cited in 1999

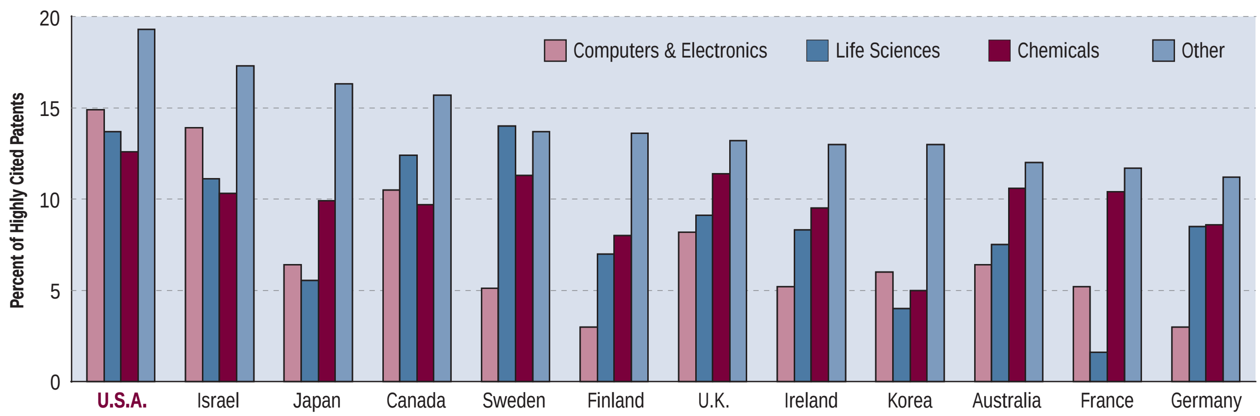


Source: CHI Research.

CHART 3.13

Foreign Inventors Are Making Breakthroughs in Key Sectors

The Share of a Country's Patents Filed between 1994 and 1998 That Were Highly Cited in 1999, by Sector



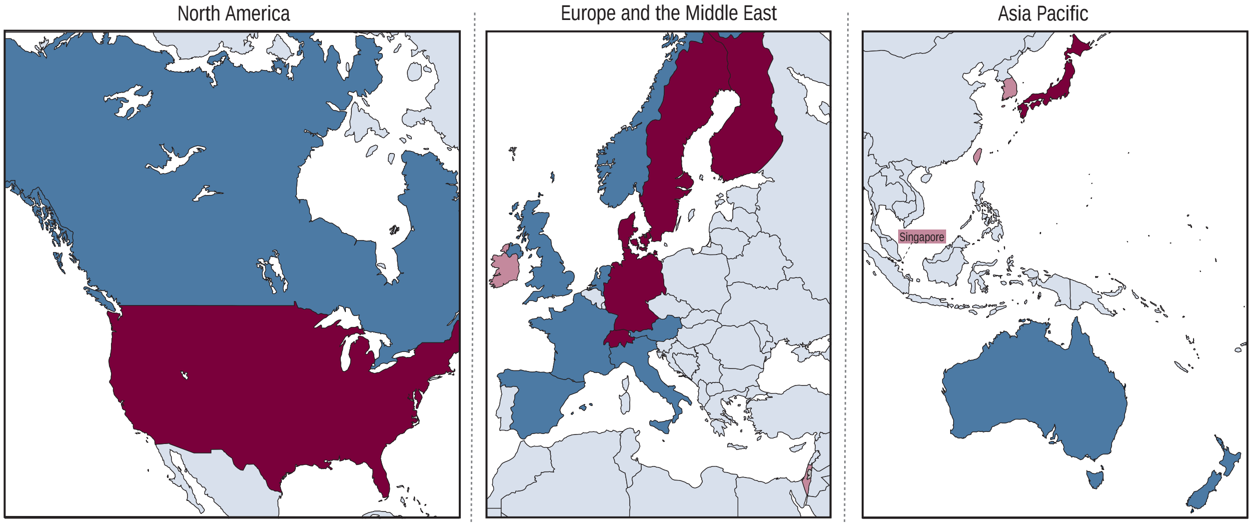
Source: CHI Research.

A New Wave of Global Innovators Is Emerging

Through the 1950s, 1960s and 1970s, the United States set the international standard for innovation. Only Switzerland, and Japan in the 1980s, were able to match the United States in per capita innovative output. In the late 1990s, however, the economic landscape began to change. A number of advanced nations increased their capacity for innovation and began to converge on the United States. Another group of emerging nations began to move up rapidly, achieving a level of innovation on a par with many developed countries. At the same time, a number of countries are developing the capacity to be fast followers, rapidly assimilating innovations that originated elsewhere.

CHART 3.14

Growing Numbers of Innovator Nations



	North America	Europe and the Middle East	Asia Pacific
Top Tier Innovators	United States	Switzerland, Sweden, Germany, Finland, Denmark	Japan
Coverging on the Top Tier	Canada	France, Austria, Norway, Italy, Spain, U.K., Netherlands	Australia, New Zealand
Emerging Innovators		Ireland, Israel	Singapore, South Korea, Taiwan

Source: Based on findings from Professor Michael E. Porter, Professor Scott Stern and the Council on Competitiveness in *The New Challenge to America's Prosperity: Findings from the Innovation Index,*1999.

SECTION 4

Sustaining Competitive Advantage: U.S. Innovation Priorities

The priorities for sustaining U.S. economic growth and competitiveness center on strengthening the nation's innovative capacity and skills of the American workforce. Although *U.S. Competitiveness 2001* suggests that there are many areas that would benefit from policy attention, innovation and skill development hold the key to increasing the nation's standard of living in the long run. The erosion in the nation's basic research investments, pool of scientists and engineers, and research facilities must be reversed to maintain U.S. leadership in innovation. The combination of global competition for markets, continuing technological development and demographic changes are putting a premium on higher-quality skills in the workforce. Finally, policymakers must recognize that many of the strongest drivers of future prosperity are concentrated at the regional level, and require strategies aimed at building up local clusters of innovative capability.

Lead in Science and Technology

The foundation for innovation is investment in frontier research, an ample pool of scientists and engineers and sophisticated research facilities. Although U.S. innovation capabilities remain strong, the nation's margin of leadership is beginning to erode. The federal government—the mainstay of long-term frontier research—funds a decreasing share of the nation's R&D investment. Yet, over 73% of industry patents cite publicly-funded science as the basis for the invention.

Given the rising bar for competitiveness, the United States needs to be in the lead or among the leaders in every major field of research to sustain its innovation capabilities. But, this goal is unachievable if the nation decreases funding for physics, chemistry, math and engineering. Jobs requiring an advanced technical degree are among the fastest growth categories in the labor market, but the numbers of undergraduate and graduate degrees in science and engineering, with the exception of life sciences, have been static or declining for more than a decade. And, the science and engineering pipeline is constrained by the lack of women and minorities and the deficiencies of high school seniors in math and science, as measured by their poor showing on international tests. Funding for modernization of research facilities has also been eroding, with over $11 billion in new construction and renovation deferred.

Priorities that stand out include:

- Increase national investment in frontier research
- Strengthen support for fundamental disciplines that have been neglected
- Expand the pool of U.S. scientists and engineers
  - upgrade K-12 math and science education
  - broaden the S&E pipeline to include women and minorities
  - create incentives for higher education institutions to increase the numbers of graduates in scientific, engineering and technical disciplines
- Modernize the nation's research infrastructure

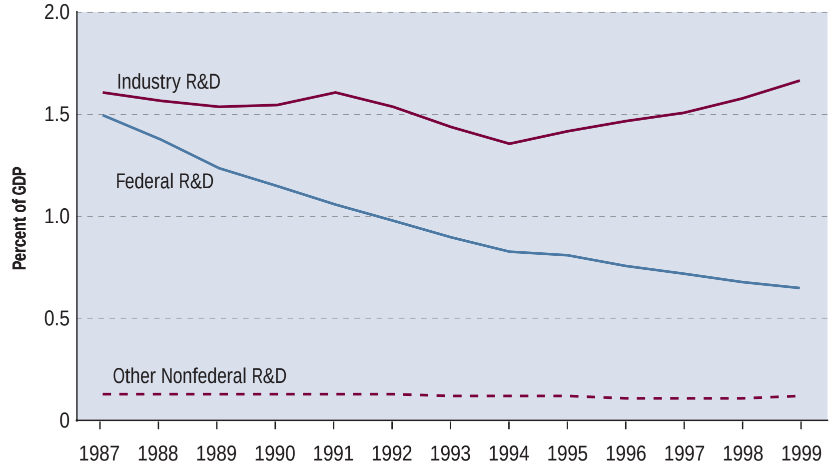
The Real Increases in National R&D Investment Have All Come from Industry, Focused on Near-Term Product Development

As shown earlier, U.S. R&D investment, as a share of national wealth, is lower today than it was in 1985. Although the dollar amount of investment in R&D grew from $115 billion in 1985 to over $200 billion in 1998, the increase was overwhelmingly due to growing investment by industry. The bulk of industry's investment, however, was properly targeted on the development of new products, processes and services, not on basic discovery.

CHART 4.1

Industry Increased Its Rate of Research Investment

U.S. R&D Funding as a Percent of GDP, by Source, 1992 Dollars

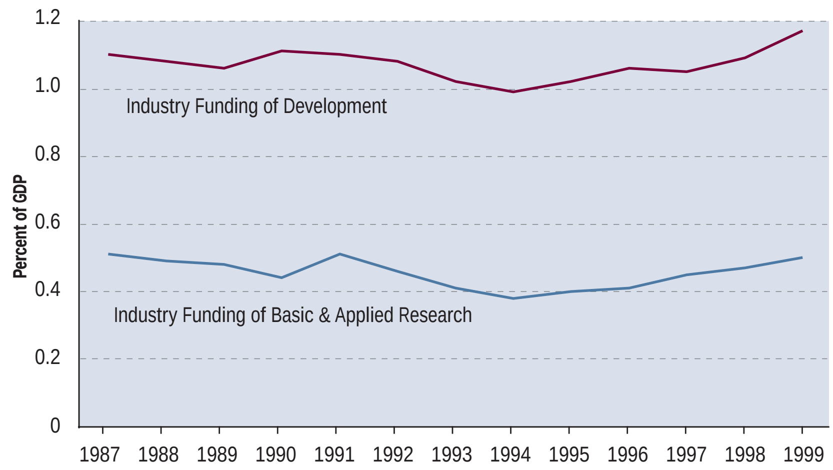


Source: National Science Foundation, *Science and Engineering Indicators 2000* CD-ROM

CHART 4.2

Industry R&D Is Focused on Product Development

U.S. Industrial Performance of Basic & Applied Research and Development as a Percent of GDP, 1992 Dollars



Source: National Science Foundation, *Science and Engineering Indicators 2000* CD-ROM

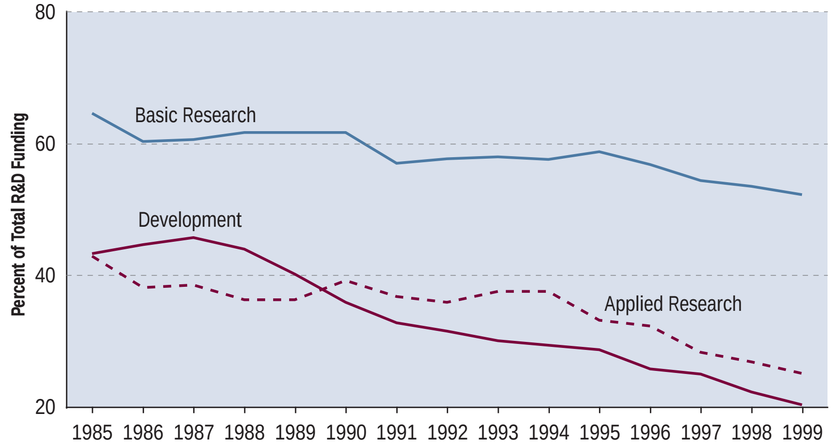
The Government Share of R&D Funding Is Declining

The federal government, the mainstay of long-term investment in creating basic knowledge and technology, provided a decreasing share of the nation's R&D investment. In real terms, the total federal contribution to the nation's R&D portfolio dropped from 46% in 1985 to 27% in 1999. Industry's dependence on public science for innovation, however, remains very high. Over 73% of U.S. industry patents cited publicly-funded science as the basis for the invention. There is a risk that declines in government funding for science could result in a decrease in the private sector's capacity for innovation.

CHART 4.3

Federal Commitments to Research & Development Have Waned

The Federal Share of Total U.S. Funding of Basic Research, Applied Research and Development, 1992 Dollars

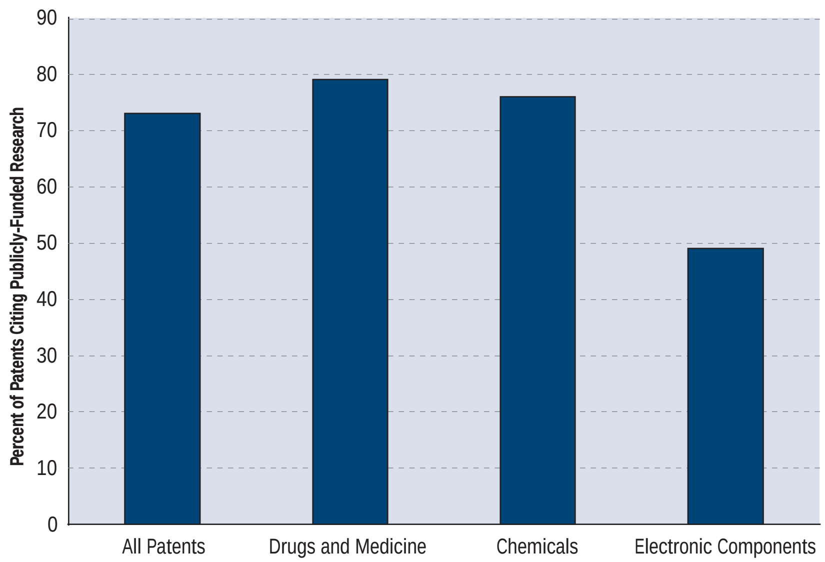


Source: National Science Foundation, *Science and Engineering Indicators 2000* CD-ROM

CHART 4.4

Private Industry Depends on Public Science to Fuel Innovation

Percent of U.S. Industry Patents Citing Publicly-Funded Research Papers, 1993–94



Source: Narin, Francis, Kimberly Hamilton and Dominic Olivastro, "Increasing Linkage Between U.S. Technology and Public Science," *AAAS Science and Technology Policy Yearbook 1998,* edited by Albert H. Teich, Stephen D. Nelson, and Celia McEnaney, p. 101.

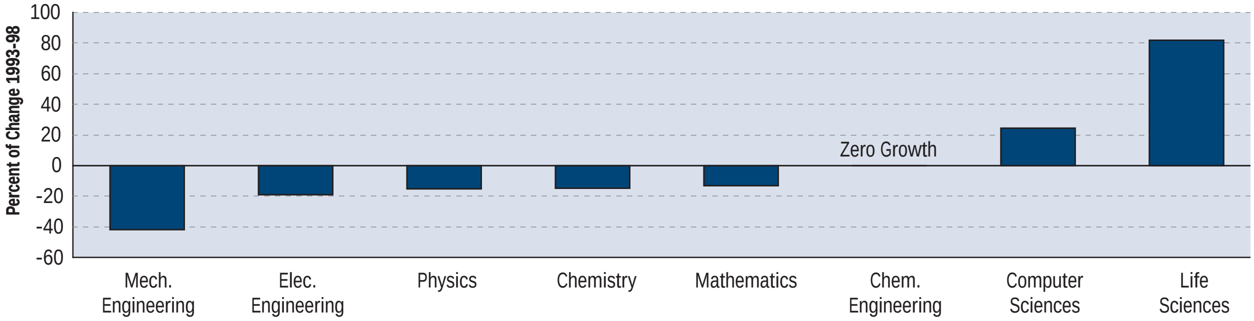
Critical Shortfalls in Research Funding Are Emerging in the Physical Sciences and Engineering

The imbalance between disciplines grew during the 1990s as funding in physics, chemistry, math and some engineering fields declined in real terms while investment in the life sciences grew substantially. The increasing complexity of advanced technology—in which multiple disciplines and technologies are integrated—depends on concurrent advances across many fields. The imbalance in America's scientific portfolio runs a serious risk of adversely affecting the capacity for innovation in a range of key sectors and impeding the ability to fulfill other critical national missions.

CHART 4.5

Funding for the Physical Sciences, Math and Engineering Declined

Percent Change in Federal Obligations for University Research by Discipline from 1993–98, 1992 Dollars



Sources: National Science Foundation, Survey of Federal Funds for Research and Development Fiscal Years 1998, 1999, 2000.

CHART 4.6

Fulfillment of National Missions Depends on Advancements Across all Major Disciplines

National Challenges	*Contributing Sciences*	*Enabling Technologies*
Improved Health Care	Biochemistry, Biology, Genetics Computer Sciences Materials Science Mathematics Physics	Clinical Evaluation Computer-aided Drug Design Gene Sequencing Technology IT, Electronics Molecular Detection
Energy & Environmental Quality	Atmospheric and Climate Sciences Biology Chemistry Computer Sciences Ecosystems Electrical Engineering Physics Sensor Technologies Measurement Technologies IT	Bioremediation Technology Clean Combustion Technology Energy Efficient Technology Manufacturing Technology Photovoltaics Radioactive Waste Mgmt. Recycling Technologies
National Defense	Computer Sciences Electromagnetic Theory Materials Sciences Physics Quantum Mechanics Robotics Transport Physics	Electronics, Computing Human-Interface Technology Manufacturing Technology Materials Technology Nuclear Technology Optical Technology Plasma Technology

Source: *Global Innovation/National Challenges*, CSIS, 1996.

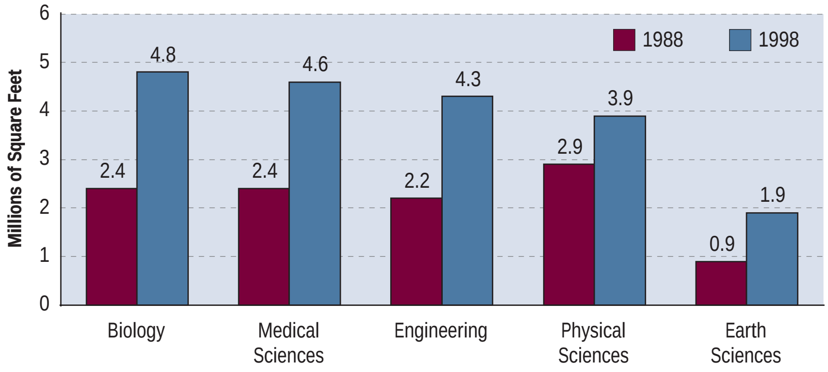
Research Facilities Are Depreciating

The quality of research is built, in part, on the sophistication of laboratory facilities. Yet, in the ten- year period from 1988 to 1998, the need to renovate or replace research facilities increased in every S&E field. In 1998, a majority of research institutions reported that they were forced to defer needed construction or repair programs—totaling about $11 billion—because of insufficient funds. At the same time, federal contributions for laboratory infrastructure declined. In 1990, the federal government provided $610 million or 14% of the cost of new construction, repair and renovation. By 1997, the federal government provided only $390 million or 9%.

CHART 4.7

The Amount of Research Space Needing Renovation or Replacement Doubled between 1988 and 1998

Millions of Net Assignable Square Feet Needing Renovation or Replacement

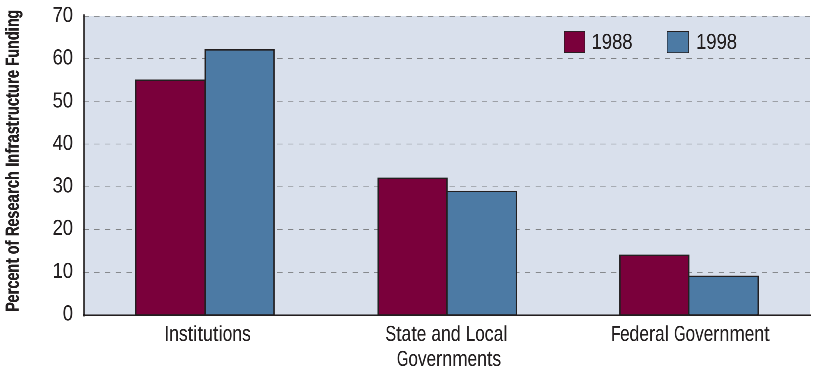


Source: National Science Foundation.

CHART 4.8

Federal Support for University Research Facilities Declined Even as Costs for Renovation and Replacement Escalated

Sources of Support for New Construction, Repair and Renovation Projects at Universities



Source: National Science Foundation.

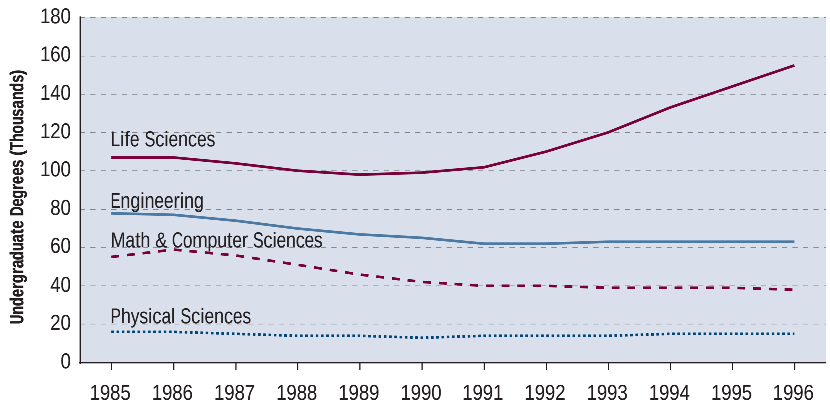
The Supply of Technically-Trained Talent Is Static or Declining Outside the Life Sciences

The vitality of research is only as strong as the nation's science and engineering talent pool. Undergraduate degrees in science and engineering, except for the life sciences, are static or actually declining. Enrollments in graduate programs in science and engineering, outside of life sciences, are on a similar downward track. Part of the problem may be economic. The share of graduate students supported by federal stipends has declined since 1980 from over 22% to 19.6%, though the cost of tuition has increased substantially.

CHART 4.9

Undergraduate Degrees Are Declining Outside of Life Sciences

Undergraduate Degrees by Discipline, Thousands

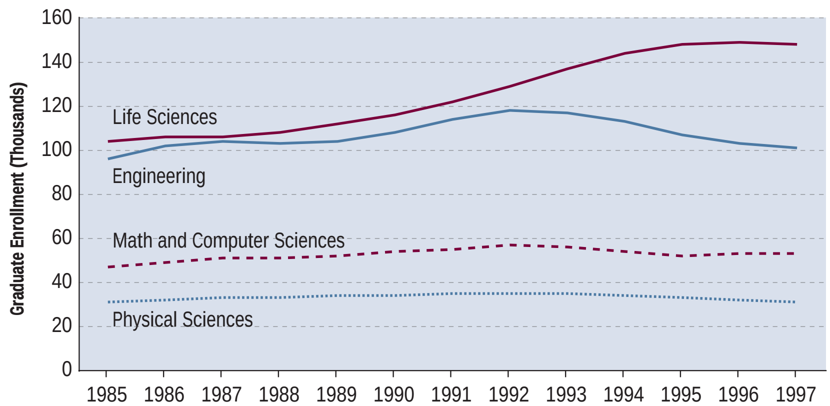


Source: National Science Foundation, *Science and Engineering Indicators 2000* CD-ROM

CHART 4.10

Graduate Enrollments Are Declining in Key Disciplines

Graduate Enrollment by Field of Study, Thousands



Source: National Science Foundation, *Science and Engineering Indicators 2000* CD-ROM

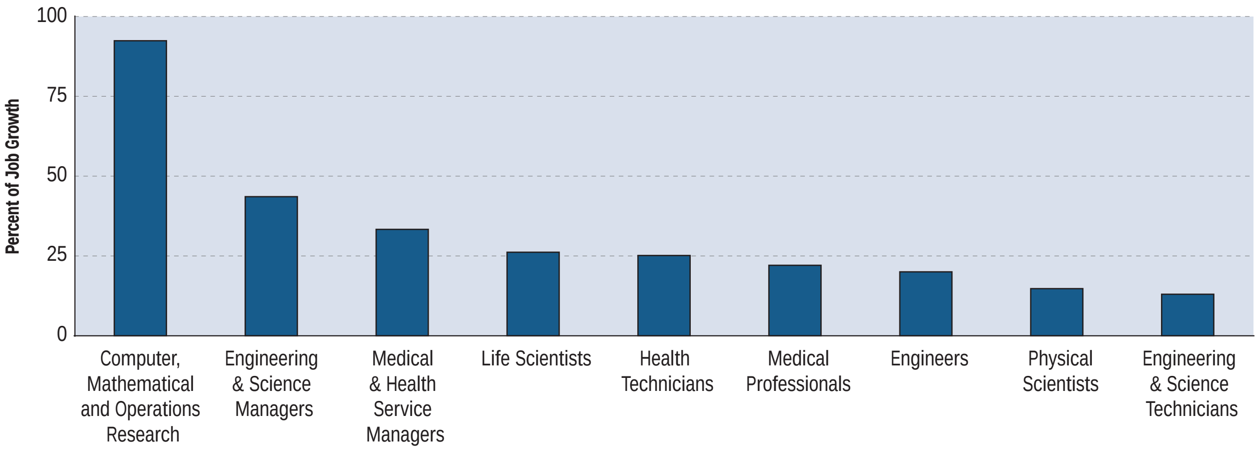
Demand for Scientists and Engineers Is Projected to Increase Four Times Faster Than Overall Job Growth

Even as enrollments and degrees decline, the demand for scientists and engineers (S&Es) is growing. The Department of Labor projects that new jobs requiring science, engineering and technical training will increase by 51% between 1998 and 2008—roughly four times higher than average job growth nationally. When net replacements are factored in, cumulative job openings for scientists, engineers and technicians will reach nearly 6 million by 2008. [5]

CHART 4.11

Jobs Requiring Technical Skills Are Projected to Grow by 51%

Projected New Job Growth by Technical Field, 1998-2008

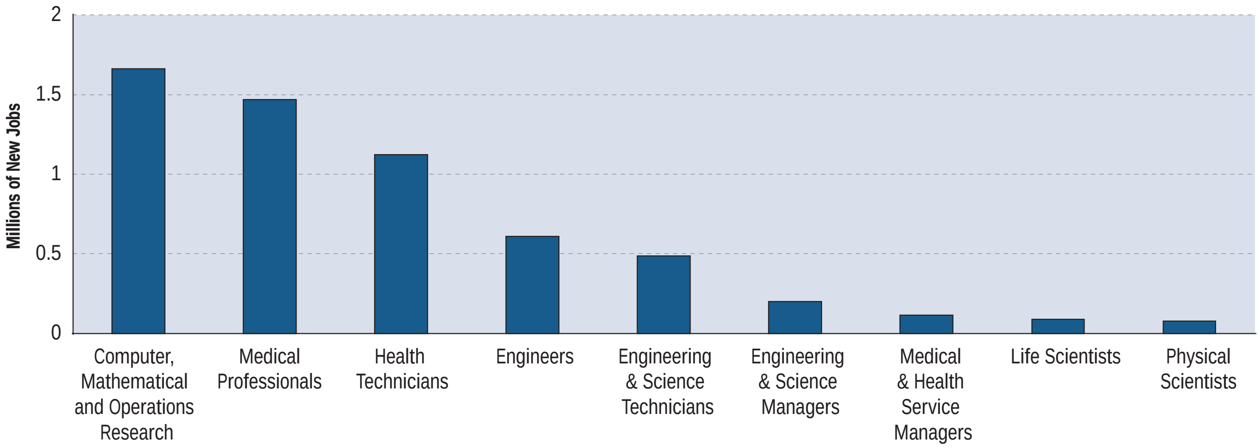


Source: Bureau of Labor Statistics, www.bls.gov.

CHART 4.12

Six Million Job Openings Are Projected for Technically-Trained Talent

Projected Number of Job Openings by Technical Field, New Jobs and Net Replacements, 1998–2008



Source: Bureau of Labor Statistics, www.bls.gov.

[5] According to the Bureau of Labor Statistics, the net replacement numbers understate the total number of job openings but "best represent the job openings for new labor force entrants over the projection period." *Monthly Labor Review Online.* November 1999, p.75.

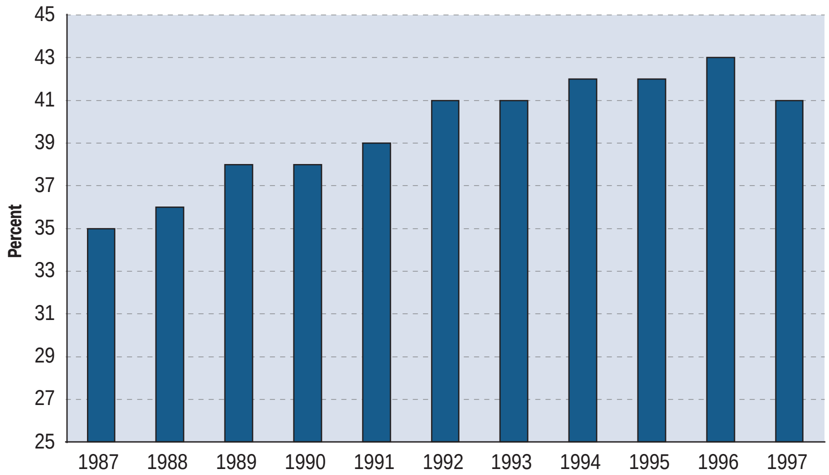
Foreign Students, Many of Whom Return Home, Comprise Over 40% of All PhDs in Science and Engineering in U.S. Universities

The proportion of foreign students receiving PhDs from U.S. institutions has increased over the past decade—from 35% of all doctoral degrees in 1987 to 41% in 1997. Although diversity in the S&E workforce is a net plus for the economy, many foreign-born scientists and engineers eventually return home to work—by choice or because of U.S. immigration requirements. Hence, there is a pressing need to expand the domestic pipeline of scientists and engineers.

CHART 4.13

A Large Share of PhDs in Science and Engineering Are Earned by Foreign Students

Percent of Degrees Earned by Foreign Students



Source: National Science Foundation, *Science and Engineering Indicators 2000* CD-ROM

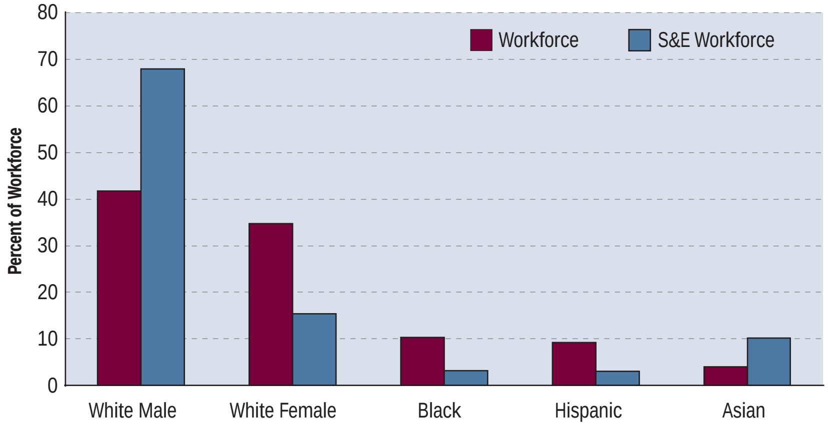
Expanding the S&E Workforce Will Require Participation by More Women and Minorities

As long as the S&E workforce is composed almost exclusively of white males, its expansion prospects will remain limited. Women and minorities represent the fastest growing segments of the workforce, but comprise only a tiny fraction of scientists and engineers. Efforts to boost their participation in the S&E workforce present the single greatest opportunity to expand the nation's pool of technical talent.

CHART 4.14

Women and Minorities Are Underrepresented in the Science and Engineering Workforce

Percent of Women and Minorities in the Workforce



Source: *Land of Plenty*, Report of the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, September 2000.

Boost Overall Workforce Skills

The nation's ability to commercialize innovation—and future productivity growth—rests on the skills of its workers. But, the bar for skills is rising—and demand for higher skills is outstripping supply.

Competition from low-wage workers overseas is reducing the number of U.S.-based jobs that require only minimal skills. Yet, over 2 million young Americans do not graduate from high school and a substantial number of those that do require remedial education. Colleges and universities spend an estimated $1 billion dollars per year on remedial programs while 35% of companies have been forced to offer courses in basic reading, writing and arithmetic.

The modern economy increasingly demands technical and reasoning skills. The fastest growing job categories require some level of postsecondary education. But, only 50% of Americans participate in postsecondary education—and the likelihood of entering and completing a 2 or 4 year college program remains closely correlated with race and socioeconomic status. Those who do not go to college are also far less likely to receive workplace training. About two-thirds of company training programs are directed at managers who have high levels of educational attainment.

Higher skills which enable higher productivity are increasingly necessary to commercialize innovation and justify higher American wages. The realities of technological change and globalization create an immediate and compelling economic stake in strengthening the skills of the U.S. workforce.

Priorities that stand out include:

- Improve math and science education
- Provide access to information technology for all students
- Raise postsecondary enrollment rates for underrepresented minorities
- Increase access to higher education for students from low-income households
- Extend training opportunities to more workers

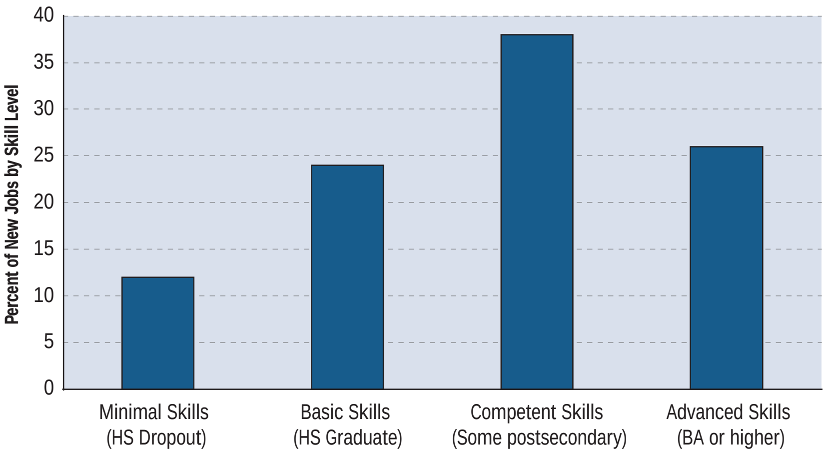
New Jobs Require Higher Skills

Although most jobs do not require an advanced degree, skill requirements are increasing for the fastest growing job categories. More than 60% of new jobs will require workers to have basic or competent skill levels. Basic skills require a minimum of a high school education while competent skills require some postsecondary education. Only 12% of new jobs can be filled by workers with minimal skills—and the number of minimal skill jobs in the economy is expected to continue to shrink.

CHART 4.15

Skill Requirements Are Increasing

Percent of New Jobs by Skill Level, 1996-2006



Source: Carnevale, Anthony P. and Donna M. Desrochers, *Getting Down to Business*, Educational Testing Service, Princeton, 1999.

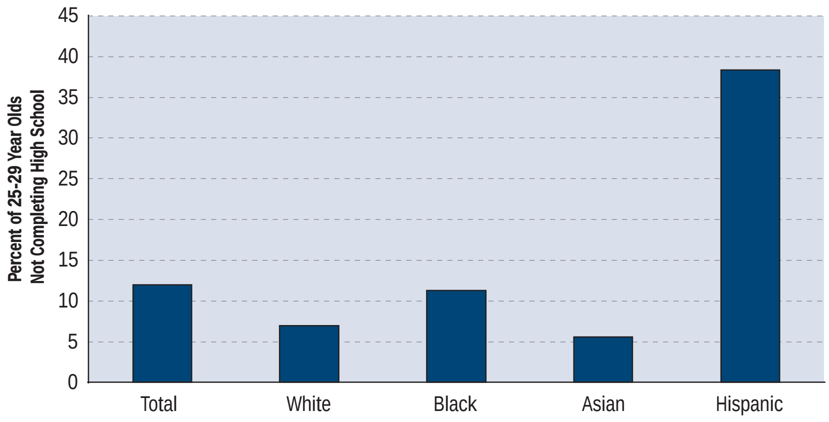
A High School Education Is an Economic Necessity

In most states, the legal dropout age is 16—an anachronism of the old-style mass production economy. Today, attainment of skills commensurate with a high school diploma is an economic necessity. But, over 2 million young Americans—nearly 12% of the 25–29 year old age group—do not graduate from high school. Rates of unemployment and poverty are 5 to 10 times higher for high school drop-outs. Although the national rates of high school graduation increased dramatically over the last century, the goal of a basic education for all Americans has not been met.

CHART 4.16

The Goal of High School Education for All Students Has Not Been Met

Percent of Population Aged 25–29 Not Completing High School

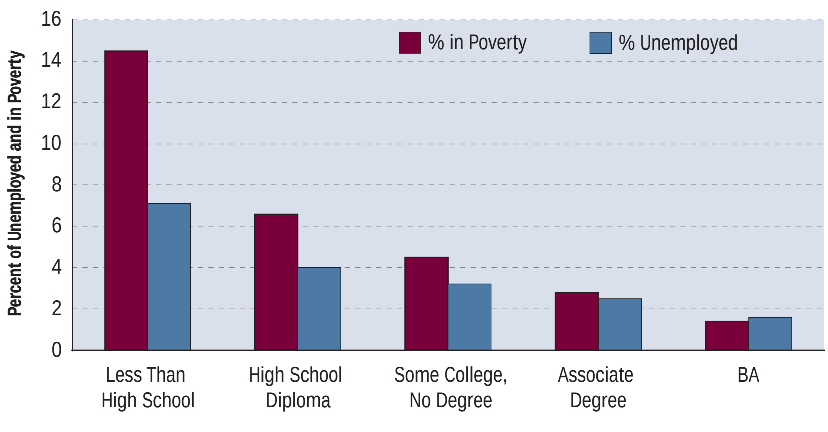


Source: U.S. Census Bureau, Current Population Reports, *Educational Attainment in the United States*, August 2000.

CHART 4.17

Without a High School Education, Workers Are Far More Likely To Be Unemployed and in Poverty

Rates of Unemployment and Poverty among Workers by Level of Educational Attainment



Source: U.S. Census Bureau, Current Population Reports, *Educational Attainment in the United States*, August 2000.

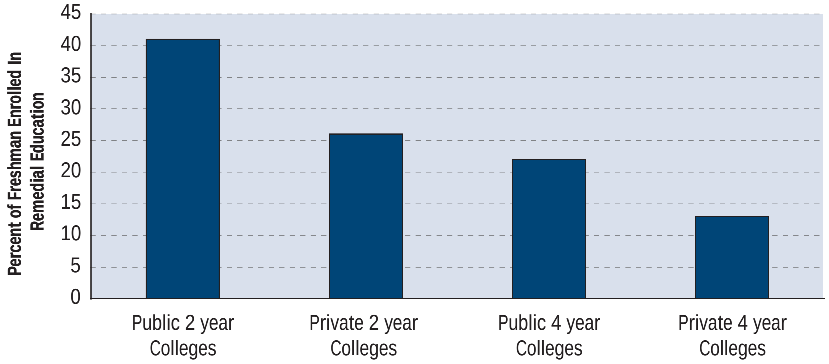
K-12 Education Is Not Making the Grade for a Substantial Share of Students

The nation's educational system is leaving a troubling number of high school graduates unprepared for the workplace or continuing education. A large number of colleges and companies see the need to offer remedial education in basic skills—skills that should have been acquired in high school. Remedial programs represent an inefficient allocation of national training and education resources. Remedial education is estimated to cost colleges and universities about $1 billion per year and involve up to one-third of all entering freshmen.[6] The K-12 system needs to get it right the first time for every student.

CHART 4.18

Substantial Numbers of Entering Freshmen Require Remedial Education

Percent of First-Time, Entering Freshman Enrolled In Remedial Education in Reading, Writing or Math, 1995

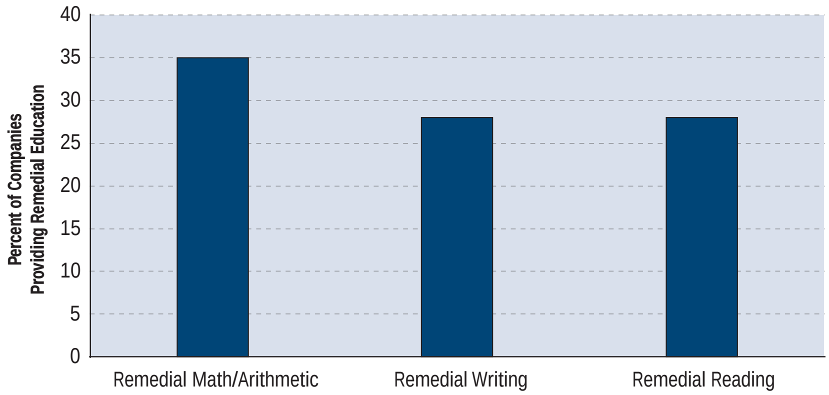


Source: Lewis, Laurie and Elizabeth Farris, *Remedial Education at Higher Education Institutions in Fall 1995,* NCES 97-584, U.S. Department of Education, National Center for Education Statistics, Washington, DC, 1996.

CHART 4.19

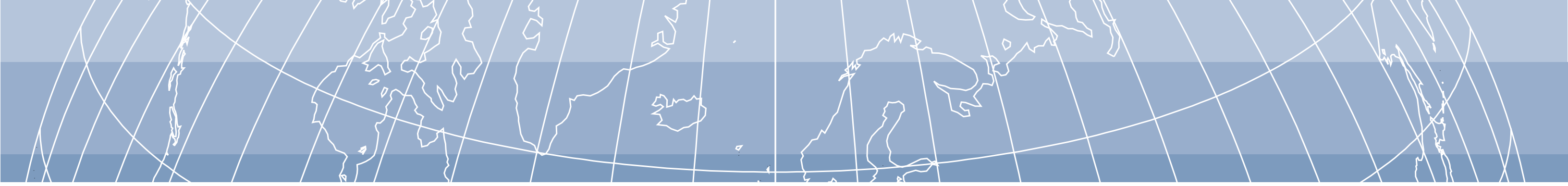
Many Companies Are Providing Remedial Education

Percent of Companies Providing Remedial Education



Source: *Training Magazine*, October 2000. Industry Report 2000.

[6] Remediation in Higher Education, Fordham Report, July 1998, www.edexcellence.net



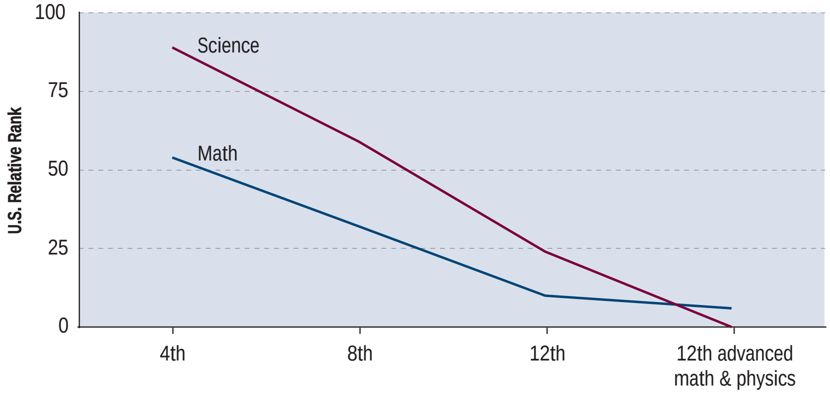
Math and Science Education at the K-12 Level Is Lagging

Low achievement by U.S. students in math and science raises concerns about the future supply of scientists and engineers, the problem-solving capabilities of the workforce and the capacity of citizens to operate in a technological society. International tests in math and science indicate that performance levels of U.S. students actually worsen with years in the system. The relatively strong performance of U.S. fourth graders gradually erodes by 12th grade. U.S. high school seniors score significantly lower in math and science than their peers in other countries.

CHART 4.20

Student Achievement in Math and Science Declines with Years in the System

TIMSS Scores—Relative U.S. Performance Versus Other Countries



Source: IEA, Third International Math and Science Study.

U.S. Students Underperform in Math and Science

CHART 4.21

International 8th Grade Mathematics and Science Assessments

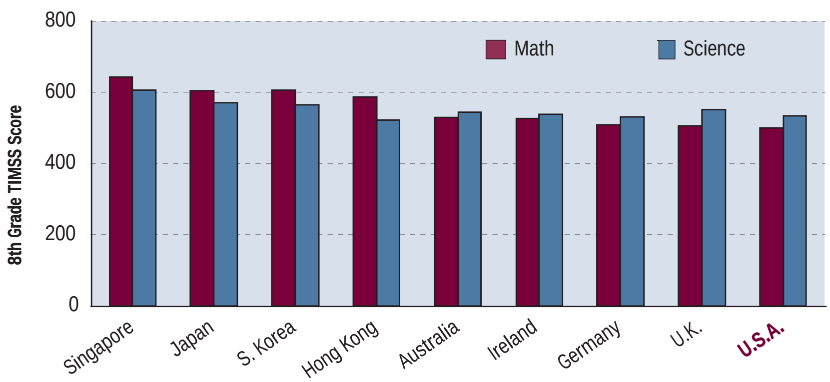
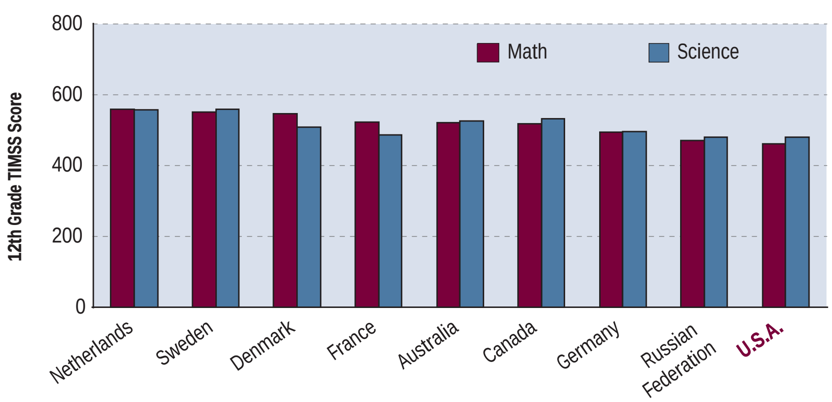


CHART 4.22

International 12th Grade Mathematics and Science Assessments



Source: IEA, Third International Math and Science Study.

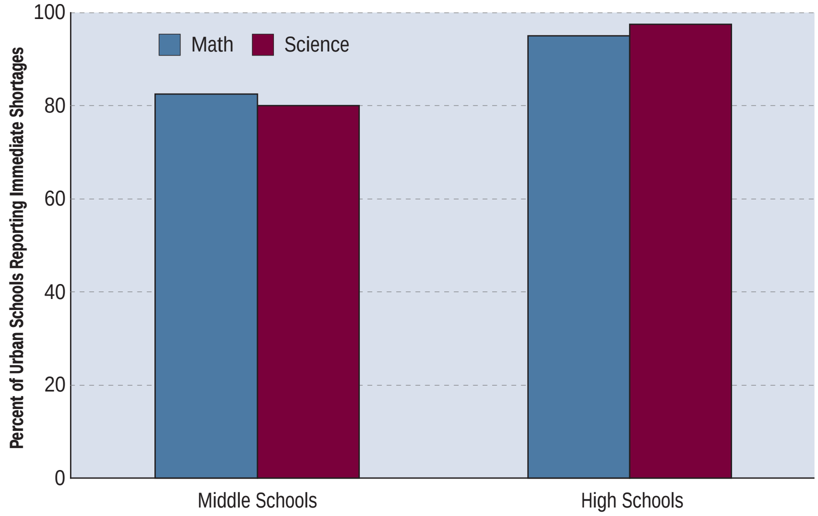
Shortages of Math and Science Teachers Are Reaching Critical Levels

Prospects for improving math and science education depend on the availability and quality of math and science teachers. But, more than 80% of urban school districts report immediate shortages. A substantial proportion of math and science teachers are not certified in their subject area. The lack of teacher certification is highest in areas with large minority populations and high concentrations of poverty. Yet, a number of studies show that full certification or a major in the field is a strong predictor of student achievement.

CHART 4.23

The Large Majority of Urban Schools Report Teacher Shortages in Math and Science

Percent of Urban Schools Reporting Immediate Shortages

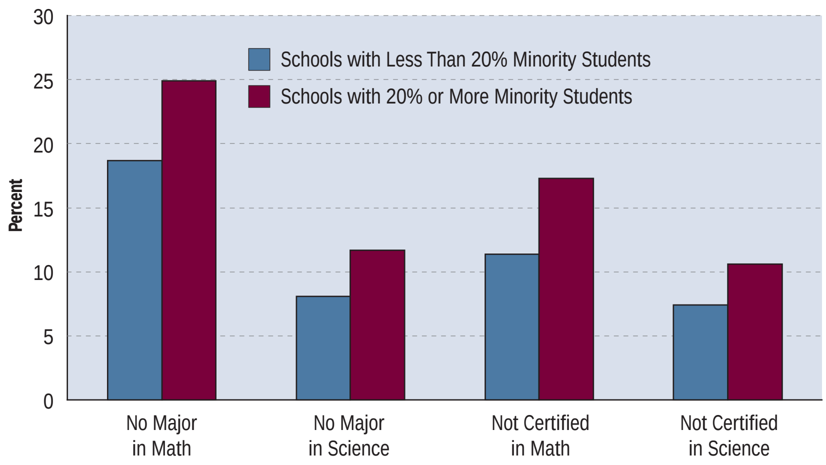


Source: *The Urban Teacher Challenge: Teacher Demand and Supply in the Great City Schools,* Recruiting New Teachers, Inc., Council of the Great City Schools, Council of the Great City Colleges of Education, January 2000.

CHART 4.24

A Substantial Share of Math and Science Teachers Lack Adequate Preparation

Percent of Public School Math & Science Teachers Without a Major or Certification in Class Subject, 1993–94



Source: National Center for Education Statistics, *Schools and Staffing Survey,* 1993–94 (Teacher Questionnaire)

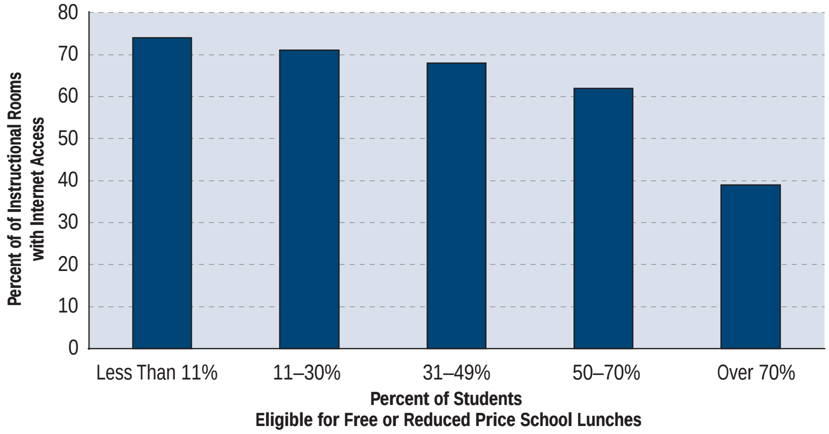
Every Student Today Needs Skills in Information Technology

Some level of computer literacy has become a baseline skill for most occupations. Access to information technology has increased dramatically, but not for schools enrolling students with high concentrations of poverty. In schools with high poverty rates, only 39% of instructional rooms had Internet access compared to 74% in wealthier communities. The number of students per computer was 16—almost double the number in wealthier communities.

CHART 4.25

The Share of Classrooms Connected to the Internet Is Substantially Lower in Poorer Communities

Percent of Instructional Rooms with Internet Access Measured against the Percent of Students Eligible for Reduced Price or Free School Lunches,1999

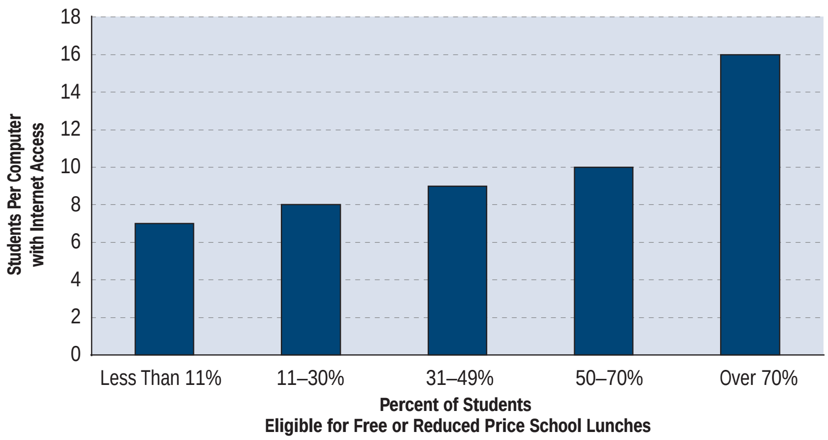


Source: National Center for Education Statistics, www.nces.ed.gov/pubs2000/2000086.pdf.

CHART 4.26

The Number of Students Per Computer Is Nearly Double in Poorer Areas

Number of Students Per Computer Measured against Percent of Students Eligible for Reduced Price or Free School Lunches, 1999



Source: National Center for Education Statistics, www.nces.ed.gov/pubs2000/2000086.pdf

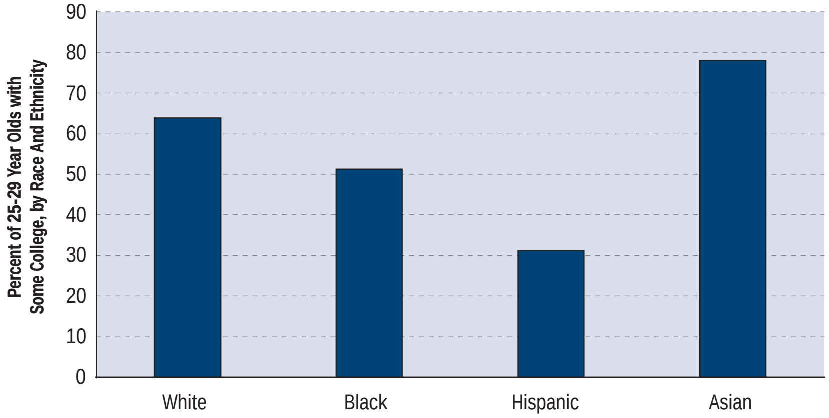
Racial and Ethnic Minorities Remain Underrepresented in Higher Education

The college-bound population is far from representative of the population as a whole. Fewer Black and Hispanic students attend or graduate from college. Given that the fastest growing jobs will require some level of postsecondary education, these demographic subgroups could be placed at a distinct job and salary disadvantage.

CHART 4.27

Differences in College Enrollment by Race and Ethnicity Have Long-term Income Implications

Percent of 25-29 Year Olds with Some College Education, by Race and Ethnicity

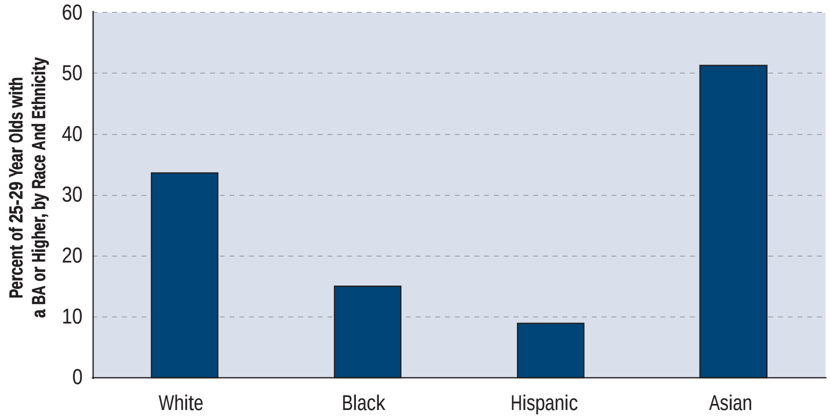


Source: U.S. Census Bureau, Current Population Reports, *Educational Attainment in the United States*, August 2000.

CHART 4.28

Wide Gaps in Educational Attainment Persist by Race and Ethnicity

Percent of 25-29 Year Olds with a BA or Higher by Race and Ethnicity



Source: U.S. Census Bureau, Current Population Reports, *Educational Attainment in the United States*, August 2000.

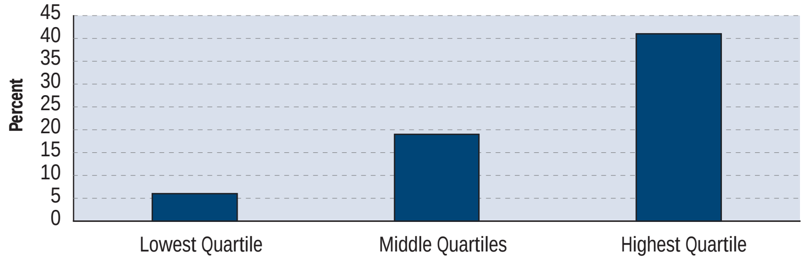
The Ability of Students from Low-Income Families To Afford a College Education Has Fallen

For low-income households, the cost of attendance at a four-year public university represents 62% of annual income versus 17% for middle-income households and 6% for high-income households. Inflation-adjusted tuition has more than doubled, but median family incomes have increased only 20% since 1992. While student aid has increased in total value, it has not kept pace with the rise in tuition. Most of the growth in aid has been in the form of student borrowing, about half of which is unsubsidized. As a result, need-based aid as a percentage of total assistance has declined substantially.

CHART 4.29

Socioeconomic Status Has a Major Impact on the Likelihood of Pursuing a College Education

Percent of Students Receiving a Bachelors Degree by Socioeconomic Status, 1989 Entering Freshman Who Received a BA or Higher as of 1994

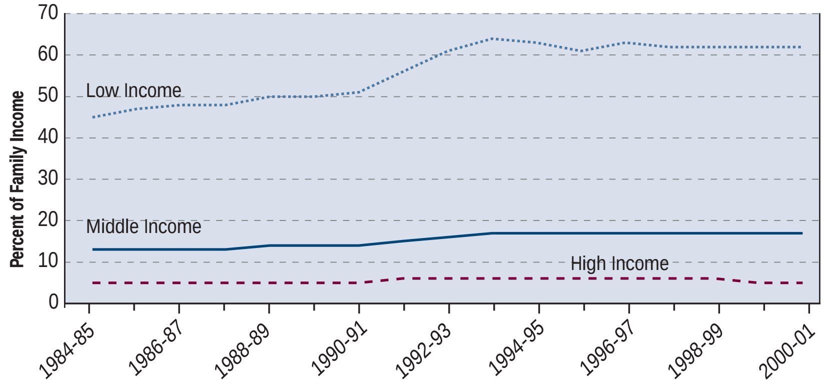


Source: College Board, *Trends in College Pricing 2000.*

Even as Tuition Was Rising as a Share of Household Income, Need-Based Aid Programs Declined

CHART 4.30

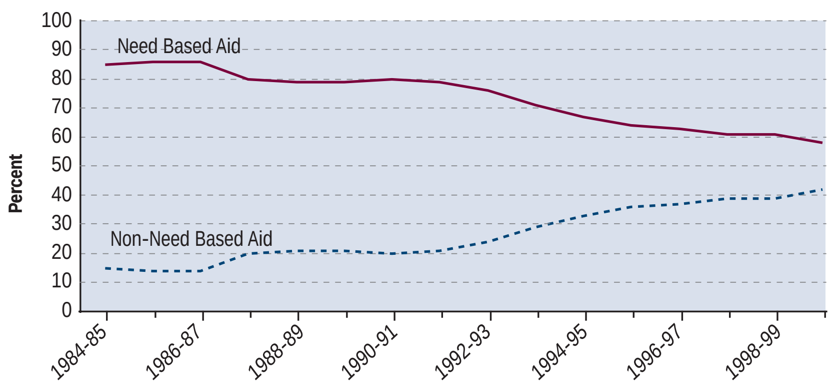
Cost of Attendance at Public Four-Year Institutions



Source: College Board, *Trends in Student Aid 2000.*

CHART 4.31

Percent of Federal Need Versus Non-Need Based Tuition Aid



Source: College Board, *Trends in Student Aid 2000.*

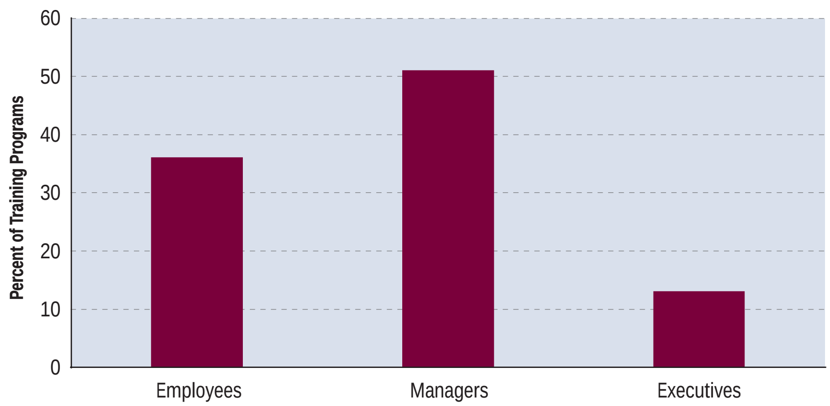
Training Programs Are Reaching Too Small a Share of the Workforce

Industry-funded training programs offer an opportunity to upgrade skills on a continuing basis. In 1999, industry spent over $54 billion on training. But, only about one-third of training dollars were aimed at workers. Two-thirds were spent on training for managers. Training funds also tend to be directed toward occupations in which workers already possess high levels of skill. At the same time, publicly-funded training programs have been focused only toward the very lowest skilled workers, and provide little support for skills enhancement for the average employee.

CHART 4.32

Two-Thirds of Corporate Training Expenditures Support Executive Training

Percent of Training Programs by Occupation

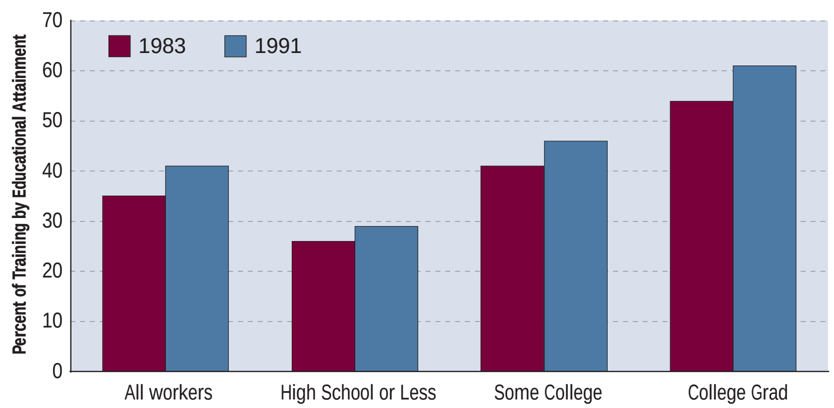


Source: National Center for Education Statistics, *Findings from Education and Economy: An Indicators Report*, nces.ed.gov/pubs97/97939.html.

CHART 4.33

Training Is Most Prevalent among More Educated Workers

Percent of Training Dollars by Educational Attainment



Source: National Center for Education Statistics, *Findings from Education and Economy: An Indicators Report*, nces.ed.gov/pubs97/97939.html.

Skills and the New Demographic Reality

The seismic demographic shift that is occurring with the aging of the 76 million baby boomers will dramatically affect America's economic growth prospects over the next several decades. With nearly 30% of the population at or over retirement age by 2030, the downward pressures on the growth of the workforce will be intense. The exit of millions of mature workers will leave not just a smaller workforce, but a relatively less experienced one as well.

To offset the slowdown in workforce growth, the nation must get all of its citizens working and encourage longer career spans. As important, the smaller workforce must become a more skilled and productive one. Department of Labor analysis shows that a 1% increase in skills has the same effect on output and productivity as a 1% increase in the hours worked. Hence, the national commitment to invest in education and training to increase skills is not just a worthwhile social objective, it is an economic necessity – and an urgent one given the generational time lag in education.

Addressing these changing demographic realities will require the nation to find ways to:

- Bring more citizens into the workforce
  - Employ the under- and unemployed
  - Raise workforce participation rates among older workers
- Increase productivity per worker
  - Increase investment in technology, training and education

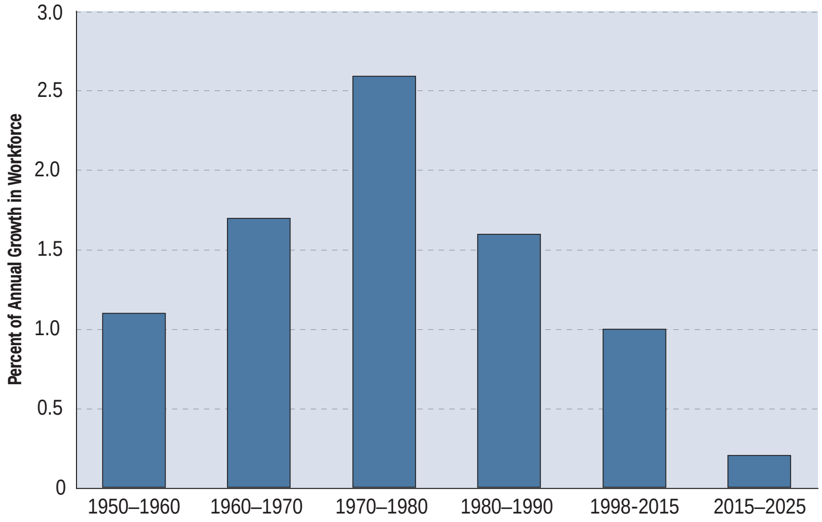
The Need for Higher Skills in a Slower Growth Workforce Is Increasing

An expanding workforce contributed more than a third of the nation's economic growth between 1985 and 1999. Whether the baby boom generation chooses to retire earlier or remain in the workforce longer will have enormous consequences for the U.S. economy. After 2008, the 65+ age group will begin to increase rapidly—comprising nearly 21% of the population by 2020 and over 26% of the population by 2030. If historically low rates of participation for older workers continue, the nation faces the possibility of near zero workforce growth. The projected annual growth in the workforce would fall from 1% between 1998 and 2015 to only 0.2% per year between 2015 and 2025.

CHART 4.34

The Average Annual Increase in the Workforce Could Fall to Near Zero Growth Levels

Annual Growth in the Workforce, 1950-98 and Projected to 2025



Sources: Fullerton, Howard, *Labor Force Participation: 75 Years of Change 1950–1998 and 1998–2025*, U.S. Department of Labor, Bureau of Labor Statistics.

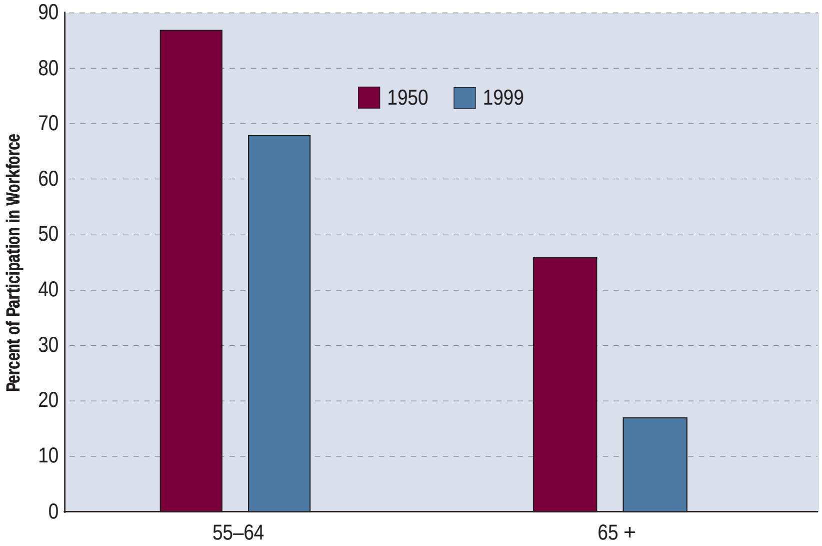
Declining Rates of Participation among Older Workers Must Be Reversed to Sustain Workforce Growth

In the 1950s, 87% of men between the ages of 55 and 64 were in the workforce. By 1999, participation of this group had fallen to 68%. Among 65-year old men, the decline was even steeper. Forty-six percent were still working in 1950, but only 17% of men over 65 remain in the workforce today. Yet, the longer and healthier life spans enabled by medical innovation permit longer careers today than in the 1950s.

CHART 4.35

Workforce Participation by Men Over 55 Years Old Has Declined Sharply

Percent of Men 55–64 and 65 and Older in the Workforce



Source: Purcell, Patrick, *Older Workers: Employment and Retirement Trends,* Monthly Labor Review Online, U.S. Department of Labor, Bureau of Labor Statistics, October 2000.

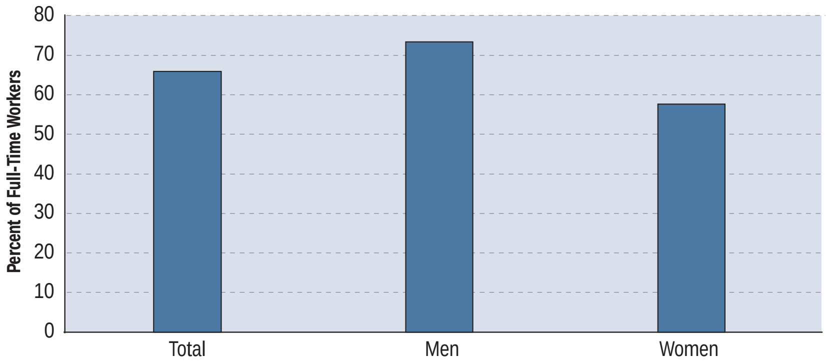
The Productive Potential of Under- and Unemployed Workers Must Be Realized

The proportion of full-time workers employed year round in 1999—at almost 66%—was the highest in 50 years. But, even with unemployment at 4%, over 6 million workers were unemployed. When discouraged job seekers and involuntary part-time workers are included, the percentage of the population that is under- or unemployed rises to 6.6% or 9.3 million potential workers. Beyond equity or fairness issues, this underutilization of talent represents unrealized productivity that the nation cannot afford to lose, particularly given the downward pressures on the size of the labor pool.

CHART 4.36

The Percentage of Workers Employed Full-Time, Year Round Reached a 50 Year High

Percent of Workers in Full-Time Jobs, 1999

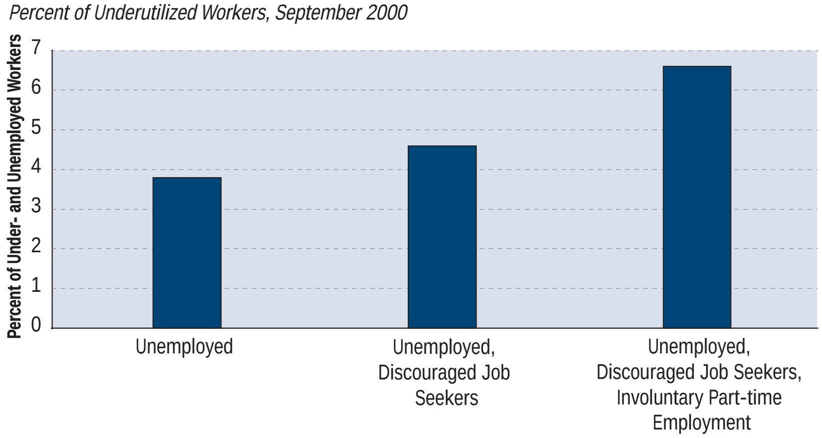


Source: U.S. Department of Labor, Bureau of Labor Statistics, TED Archives.

CHART 4.37

But, Nearly 7% of the Workforce – or 9 Million Workers – Remains Under- or Unemployed

Percent of Underutilized Workers, September 2000



Source: U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey Labor Force Statistics.

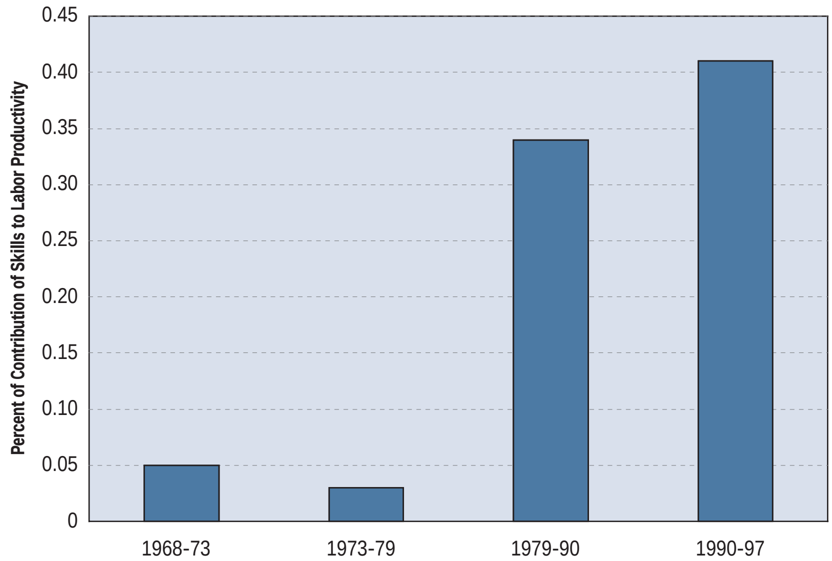
Investment in Human Capital Will Be Necessary to Offset a Slow-Growth Workforce

Even if the United States is successful in engaging more citizens in the workforce, investment in human capital remains a critical priority. The retirement of millions of baby boomers will leave not just a smaller workforce, but a relatively less experienced one. Investment in education and training to boost overall workforce skills will be essential to offset the negative effects on productivity of a combination of slow workforce growth and less experience. The evidence documenting the relationship between skills and productivity growth is compelling. More than one-quarter of the growth in labor productivity during the 1990s is attributed to increases in worker skills, as measured by education and work experience. Department of Labor analyses find that a 1% increase in worker skill levels has the same effect on output and productivity growth as a 1% increase in hours worked.

CHART 4.38

Increased Skills Boost Productivity

Contribution of Increased Skill to Labor Productivity



Source: U.S. Department of Labor, Bureau of Labor Statistics, TED Archives.

Strengthen Regional Clusters of Innovation

Although national boundaries matter less in some respects in a global economy, the clusters of firms and industries concentrated at the regional level matter more. Clusters develop where a critical mass of companies, suppliers, service providers and supporting institutions in a particular field (e.g. research institutions, trade associations, technical or vocational schools) are concentrated geographically.

Although some have argued that Internet-facilitated transactions make geography irrelevant, the latest Council research yields precisely the opposite conclusion. The locus of innovative activity that supports national prosperity is increasingly tied to geographic location.

Industry clusters innovate more rapidly because they facilitate access to information, specialized skills and business support. The strong competitive pressures on the ground, not hundreds or thousands of miles away, increase a cluster firm's motivation and ability to innovate. Proximity to universities helps to refine the research agenda, train new talent and enable faster deployment of new knowledge. Regional public-private networks improve the physical and policy environment for cluster innovation.

The early data show that average wages in regional clusters that trade nationally and internationally are significantly higher and that regions with strong clusters have higher rates of innovation, productivity growth and new business formation. The ongoing cluster research also suggests that the basis of competition between regions is changing. Competition is based on building clusters of regional assets, and not on attracting investment through large tax incentives. Building clusters requires a focus on local strengths: research capabilities, the talent pool of skilled workers in specialized areas and the regional networks that connect business with local innovation assets.

Strengthening regional clusters of innovation will require the nation to:

- Expand the focus of competitiveness and innovation policy to the regional level
- Support regional leadership initiatives and organizations that enhance and mobilize cluster assets
- Identify best practices in cluster development

The Nation's Most Productive Assets Are in Industries That Compete Nationally and Internationally

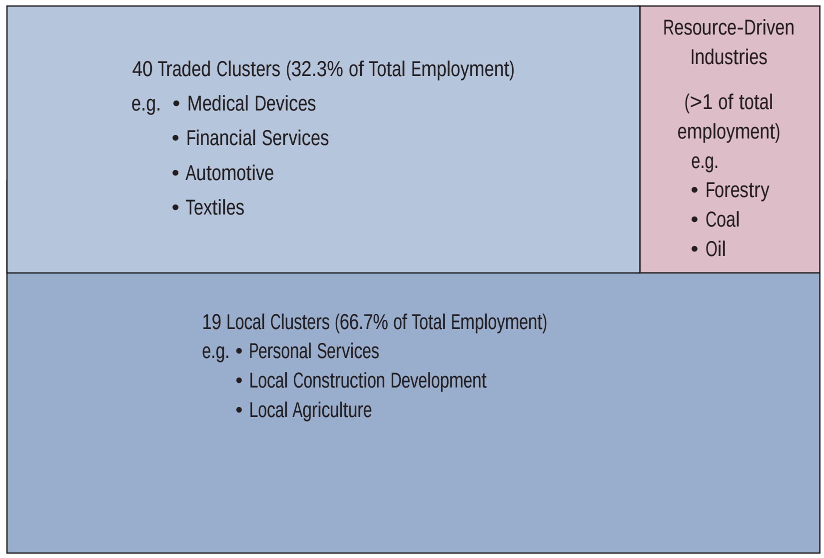
Regional economies have three generic types of activities. Traded clusters, which involve products and services that must compete nationally and internationally, can be located anywhere. These include fields such as medical devices, financial services, textiles, automotive products and services. Local clusters consist of products and services tied to the local economy, such as retailing, local construction or local agriculture. These clusters are found in every region. Resource-driven clusters, such as coal or timber, are located in the geographic areas in which the resources are found.

Local clusters, many of which involve services, account for roughly two-thirds of employment in an average region. However, economic prosperity and growth are heavily driven by traded clusters. Traded clusters have substantially higher wages and shipments per worker. The success of traded clusters also creates much of the demand for local clusters.

In the United States, resource-driven clusters account for less than 1% of employment.

CHART 4.39

The National Economy Is Composed of Traded Clusters, Local Clusters and Resource Clusters



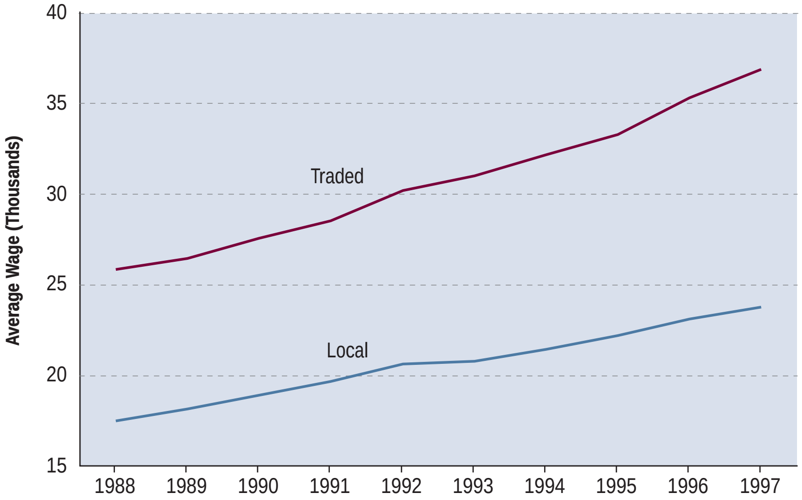
Source: Cluster Mapping Project, Institute for Strategy and Competitiveness Data for 1997.

Traded Clusters Generate Higher Wages

Innovation is concentrated in traded clusters. This higher productivity is reflected in the higher wages paid to workers. In 1997, the average wage paid to workers in traded clusters was nearly $37,000 versus $23,800 in non-traded clusters—a 55% wage premium. Wages in traded clusters have grown 0.5% faster per year since 1988.

CHART 4.40

The Wage Gap between Traded and Local Industries Is Widening



Source: Cluster Mapping Project, Institute for Strategy and Competitiveness.

The Mix of Industry Clusters Varies Substantially by State

Each state economy has a unique mix of clusters, which means that even neighboring states and regions have economies that are often very different. States with strong clusters tend to have higher growth rates in employment and establishments. Strong clusters tend to be self-reinforcing.

CHART 4.41

The Mix of Clusters Varies Widely by State

Automotive	*Information Technology*	*Pharmaceuticals*	*Textiles*
Michigan	California	New Jersey	North Carolina
Ohio	Texas	California	Georgia
Indiana	Massachusetts	New York	South Carolina
California	New York	North Carolina	Virginia
Tennessee	Minnesota	Illinois	Alabama
Illinois	Oregon	Pennsylvania	Pennsylvania
Missouri	Arizona	Texas	California
Wisconsin	North Carolina	Indiana	Tennessee
New York	Colorado	Conneticut	New York
Pennsylvania	Washington	Ohio	Massachusetts

Source: Cluster Mapping Project, Institute for Strategy and Competitiveness.

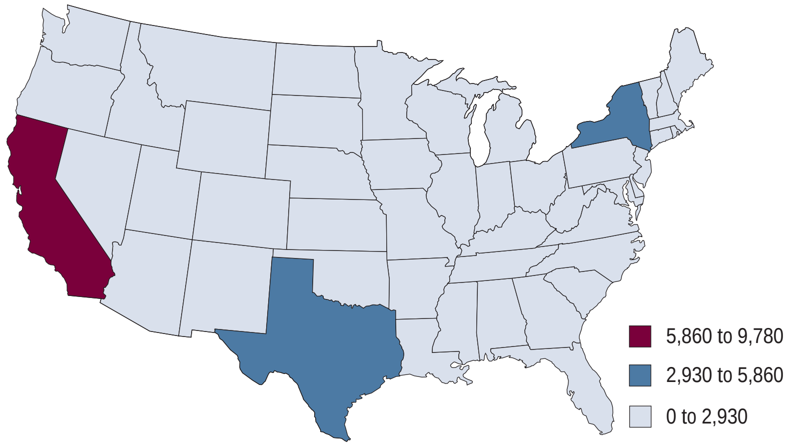
Innovation Output Is Higher in Clusters

One measure of innovation output is patenting. The strongest clusters in every field generate higher numbers of patents. All top-ranked clusters generate the most numbers of patents nationally.

CHART 4.42

Patenting Activity in the Information Technology Cluster

Total U.S. Patents, 1993–97

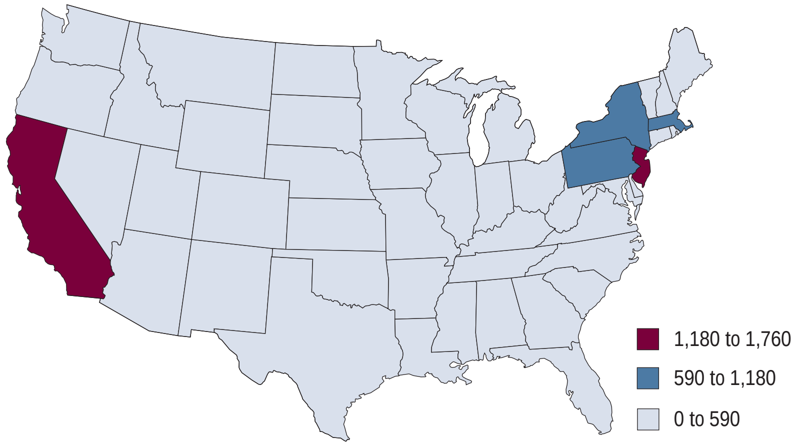


Source: Cluster Mapping Project, Institute for Strategy and Competitiveness.

CHART 4.43

Patenting Activity in the Pharmaceutical/Biotechnology Cluster

Total U.S. Patents, 1993–97

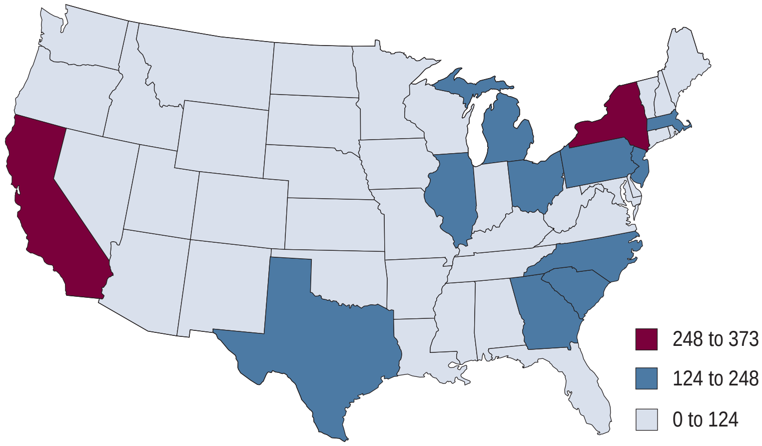


Source: Cluster Mapping Project, Institute for Strategy and Competitiveness.

CHART 4.45

Patenting Activity in the Textile Cluster

Total U.S. Patents, 1993-97



Source: Cluster Mapping Project, Institute for Strategy and Competitiveness.

Clusters of Innovation Project

The Council on Competitiveness and the Cluster Mapping Project are in the midst of a major initiative designed to identify and map clusters of innovation at the regional level and understand the influence of clusters and regions as a whole on innovation. The project, directed by Michael Porter of the Harvard Business School and Duane Ackerman, CEO of BellSouth, is pursuing several avenues of primary research. The Cluster Mapping Project has created a detailed statistical analysis of county level business data that defines 40 industry clusters in the U.S. economy and maps regional economies by cluster and constituent industry, together with their employment, average wages, new establishment formation, and patenting. This data allows an objective, quantitative assessment of the composition of the economy and the drivers of innovation and prosperity. The Council is also taking a close look at clusters in five regions: San Diego, Atlanta, Pittsburgh, Raleigh-Durham and Wichita. Surveys of business, university and community leaders have been augmented by extensive interviews in each region and a quantitative assessment of the performance of the regional economy. The first regional study will be released at the Council's National Innovation Summit in San Diego on April 5th, 2001.

Renewing the National Commitment to Innovation

In the long run, America's standard of living will depend on the nation's capacity for innovation. The production of high-value goods and services using the most advanced methods is the only way that we can continue to support our extraordinary wages and returns to capital. At this moment of economic uncertainty, however, there is enormous pressure to focus narrowly on the short term. Many seem to assume that applying economic stimulus to get us past the current downturn is the nation's only challenge. Despite the abrupt slowdown of the U.S. economy, America's technological leadership is still seen as unassailable. Many believe that the dominance of U.S. companies in global markets will remain secure, and that America's standard of living will continue to lead the world. Yet none of these outcomes is inevitable if the nation's long-term capacity for innovation is not assured.

U.S. Competitiveness 2001 highlights how America's economic resurgence was fueled in large measure by the nation's historic investments in research, education, skills and technology. While U.S. companies are on the front line of innovation, public policies have been instrumental in shaping a supportive environment. Yet, the public commitment to support the fundamentals of innovative capacity has been lagging for a decade and more. The vision that sustained 50 years of public investment in research and innovation must be renewed.

Many of America's most innovative and competitive industries today were built on decades of federally funded frontier research—often in fields that, at the time, had no discernible application. No one imagined in the 1940s that the arcane field of quantum mechanics would launch the semiconductor revolution. The engineers developing time-sharing and packet-switching techniques did not envision the worldwide web or e-commerce. Even in fields where the potential applications were clearer, such as genetic engineering, it took over three decades of patient public investment before the technology could be exploited commercially.

Public investments also had much to do with creating the pool of scientists and engineers on which America's innovative capacity depends. Beginning with the Morrill Act of 1862, public support led to growth in the number of scientists and engineers that far exceeded the growth of the overall population. The GI Bill in the late 1940s and 1950s drew World War II veterans to college, many of whom studied science and engineering. The Space Race in the 1960s energized the imaginations of students, sparking renewed interest in technical careers.

America's innovative performance has also rested on an early and concerted effort to raise the level of education of the overall population. The public policy goal of universal education was a major force in creating a workforce able to make the transition from an agrarian to an industrial society. The percentage of the population graduating from high school rose from just over 10% at the beginning of the 20th century to nearly 90% by its end.

Innovation has been a national priority in the United States to a degree unmatched elsewhere. However, the public policy consensus that has historically supported the nation's investment in innovation has seriously eroded. The United States has been *reducing* the share of resources committed to basic research for over a decade. The nation's pool of scientists and engineers is *shrinking*, and there is no long-term vision, akin to the GI Bill, to replenish it. While efforts to improve K-12 education are important, the challenge is far greater. Even if the nation is successful in improving basic education, a population educated only at a high school level will not be adequately skilled to sustain U.S. prosperity. More and more Americans are unable to afford higher education given the rising costs and the declining financial support available.

In the short run, the vagaries of the economic cycle will capture the attention of Americans. In the long run, the eroding base for innovation is the real challenge and the binding constraint on our standard of living.

U.S. Competitiveness 2001 highlights the need for a new national innovation policy. Such a policy is as critical to the nation's future as sound fiscal or monetary policy, and probably more so. While fiscal and monetary policy play a necessary role in the nation's rate of economic growth, they are not sufficient. Can the United States see beyond the short term and make investments that will underpin the nation's fundamental competitive vitality? Can the United States restore its commitment to innovation without the impetus of the Cold War? The answers to these questions will be the determining factors in America's prosperity over the next several decades.

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U.S. Telephone Association

ABOUT THE COUNCIL

Who We Are

The Council sets an action agenda to drive U.S. economic competitiveness and leadership in world markets in order to raise the standard of living for all Americans. We focus on strengthening U.S. innovation, upgrading the workforce, and benchmarking national economic performance. Our members are corporate chief executives, university presidents, and labor leaders. Our national affiliates include nonprofit research organizations, professional societies, and trade associations.

How We Operate

The Council shapes the national debate on competitiveness by concentrating on a few critical issues. These issues include technological innovation, workforce development and the benchmarking of U.S. economic performance against other countries. Members and Council staff work together to assemble data, develop consensus-based recommendations and implement follow-up strategies in every region of the country.

Our work is guided by a 30-member Executive Committee. A staff of 18 provides research and operational support. Chief executives from 50 of the country's most prominent nonprofit research organizations, professional societies and trade associations contribute their expertise as national affiliates of the Council.

The Council on Competitiveness is a nonprofit, 501 (c) (3) organization as recognized by the U.S. Internal Revenue Service. The Council receives funding from its members, foundations and project sponsors.

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PUBLICATIONS

The New Challenge to America's Prosperity: Findings from the Innovation Index

A path-breaking comparison and projection of the innovation capabilities of the U.S. and 24 other nations based on a new set of quantitative indicators. This is a companion to *Going Global*. March 1999 ($35) [If buyers want to also purchase *Going Global* (which is $40 per copy), the two can be purchased together for $60]

Going Global: The New Shape of American Innovation

This report explores the globalization of R&D investment and the strengths and weakness of the U.S. platform for innovation in five key sectors: health, information technology, advanced materials, automotive and express package transport. September 1998 ($40)

Competing Through Innovation: A Report of the National Innovation Summit

A report on the first-ever National Innovation Summit held in March 1998 at MIT bringing together 150 corporate chief executives, university presidents, labor leaders, governors, and members of Congress from across the country. June 1998 ($5)

Winning the Skills Race

This report, based on a year of site visits, benchmarks best practice in collaboration between employers, workers, educators, and government officials to upgrade the skills of the U.S. workforce. May 1998 ($25)

1996 Competitiveness Index: A Ten-Year Strategic Assessment

This tenth-anniversary report assesses U.S. gains and vulnerabilities in competitiveness over the past decade. The report explores U.S. gains in recapturing global market shares, growth of per capita GDP, the reduction of the budget deficit, and job creation. Top leaders in business, education and labor provide personal commentaries. October 1996 ($25)

Endless Frontier, Limited Resources: U.S. R&D Policy for Competitiveness

The report examines research and development trends in six key industry sectors, provides policy guidelines to meet the challenges confronting the stakeholders in America's R&D enterprise, and sets the agenda for a national discussion on the future of R&D by focusing on industry/government/university partnerships. April 1996 ($25)

Highway to Health: Transforming U.S. Health Care in the Information Age

This report identifies barriers and recommends steps to overcome them in order to develop key health care market segments by leveraging the national information infrastructure. March 1996 ($25)

Building on Baldridge: American Quality for the 21st Century

This report reviews the effectiveness of and gives recommendations for the continuation and expansion of the Malcolm Baldridge Quality Award program in promoting quality principles and practices. July 1995 ($5; copies)

Human Resources Competitiveness Profile

This report identifies barriers and recommends steps to overcome them in order to develop key health care market segments by leveraging the national information infrastructure. April 1995 ($15)

Breaking the Barriers to the National Information Infrastructure

The third in a series of policy documents, this report highlights the Council's September 7-8, 1994 NII applications conference. It lists and examines the barriers users are facing in manufacturing, education, electronic commerce, health care and entertainment in order to set the stage for a more constructive national policy debate. December 1994 ($25)

Critical Technologies Update 1994

An update from the Council's Gaining New Ground report, this document re-evaluates America's performance in 94 critical technologies. September 1994 ($10)

Economic Security: The Dollar$ and Sense of U.S. Foreign Policy

This report analyzes eight case studies involving recent foreign policy decisions, with emphasis on export controls and export sanctions, and tallies their cost to the U.S. in terms of lost exports and jobs. February 1994 ($25)

Competition Policy: Unlocking the National Information Infrastructure

The second in a series of NII policy reports, this statement offers the best thinking from a broad cross-section of the private sector on the competitive pressures driving the evolution of the U.S.-based communications industry. December 1993 ($25)

Roadmap for Results: Trade Policy, Technology and American Competitiveness

This book examines the U.S. government's ability to address the trade problems of high-tech industries. It documents the failings of the current trade policy process and recommends a new approach. June/July 1993 (Book: $40; Report: $25)

Capitol Choices: Changing the Way Technology Invests in Industry

This report investigates U.S. corporate time horizons and investment behavior. It compares U.S. governance, management and employment structures, and capital provider/capital user relationships with Germany and Japan. June 1992 ($40)

Gaining New Ground: Technology Priorities for America's Future

The first-ever private sector consensus on U.S. technology priorities, this report identifies the critical technology driving the economy and offers recommendations for strengthening U.S. leadership in these areas. March 1991 ($40)

Newsletter

Challenges Developments affecting American competitiveness — from public policy to private action, in the U.S. and around the world — are covered in this award-winning bulletin. Published quarterly.

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