BEA's R&D Satellite Account: A Step Toward Improving the Measurement of Intangibles in the National Accounts

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-National Economists Club
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Measuring the Nation's Economy.

BEA
BUREAU OF ECONOMIC ANALYSIS
U.S. DEPARTMENT OF COMMERCE

Overview

- Motivation
- Satellite Accounts at BEA
- Conceptual challenges for measuring R&D investment
- Overview of the estimation process
- Results from September 2007 release
- Next steps

Why measure expenditures on intangibles as investment?

- Economic theory:
  - Expenditures on tangible and intangible products that reduce current consumption and increase future output should be treated as investment
- National accounting consistency
  - Many intangible expenditures have the qualities of produced assets
- Improved measurement of intangibles important for:
  - Improving accuracy of GDP estimates
  - Developing quantitative measures of innovation
  - Identifying sources of economic growth

Satellite Accounts at BEA

- Present data on a particular economic activity that is internally consistent with the national accounts.
  - The U.S. Travel and Tourism Satellite Accounts (TTSAs)
- Provide an experimental framework to develop new concepts and methods
  - R&D Satellite Account: 1994, 2006, 2007
  - Integrated Economic and Environmental Satellite Accounts: 1994
- Looking ahead
  - Health and Innovation accounts, research underway

Not all types of Intangible Assets are candidates for the national accounts

- Technology-based
  - Patented technology
  - Computer software
  - Computer mask works
  - Unpatented technology
  - Trade secrets
  - Databases
- Artistic & Literary
  - Plays, operas, ballets
  - Books, magazines, newspapers
  - Musical works
  - Pictures, photographs
  - Motion pictures, films, music videos
  - Television programs

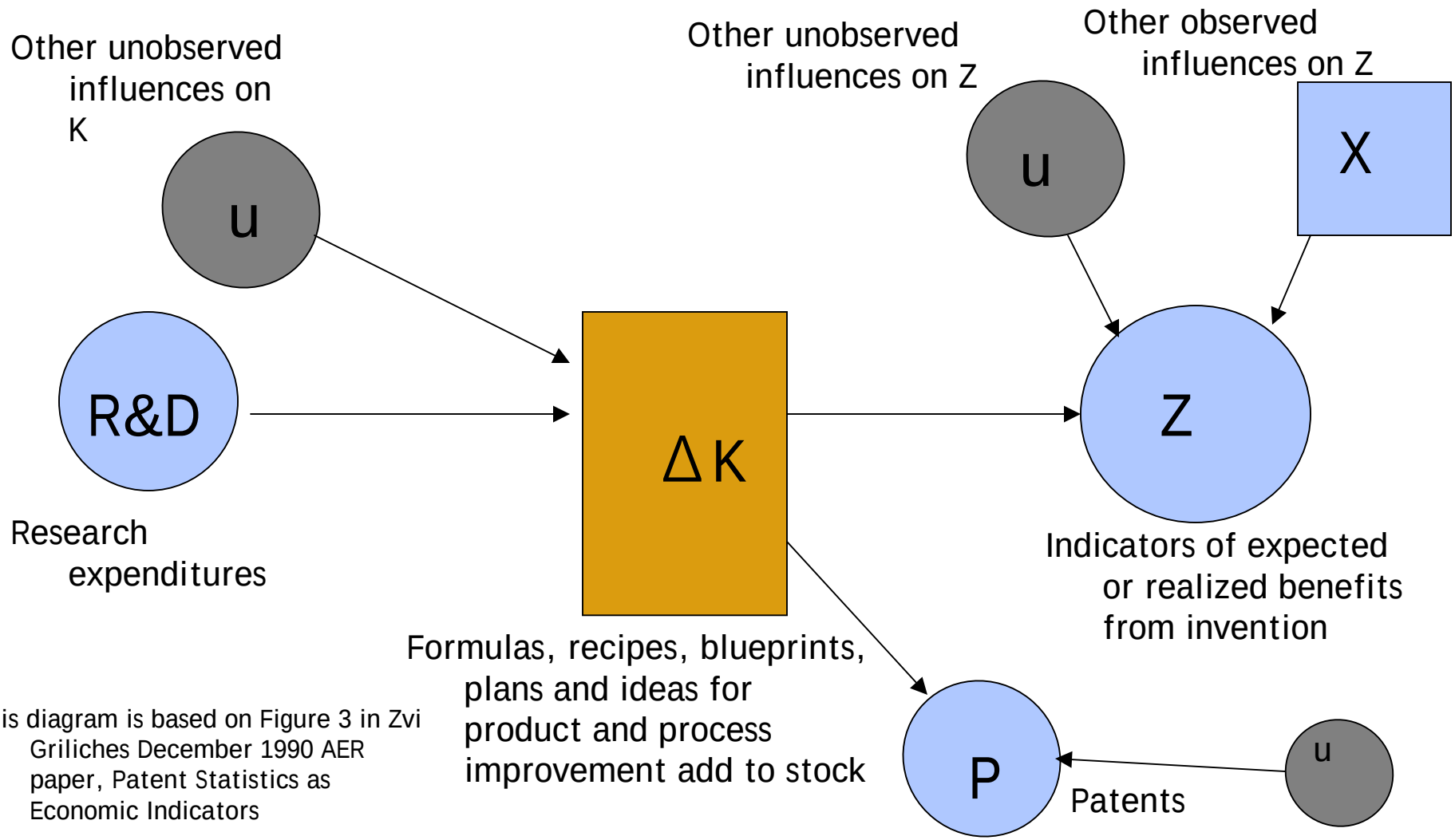
Good data exist here

- Marketing related
  - Trademarks, trade names, service marks
  - Newspaper mastheads
  - Internet domain names
  - Noncompetition agreements
- Customer related
  - Customer lists and contracts
  - Order or production backlog
- Contract-based
  - Licensing, royalty, standstill agreements
  - Advertising, construction, management, service or supply contracts
  - Lease agreements
  - Construction permits
  - Franchise agreements
  - Operating and broadcast rights
  - Employment contracts
  - Natural resource use rights

Conceptual Challenges

- **Definition of the unit of R&D output**
- R&D output price index
- Depreciation and obsolescence
- Public goods qualities of R&D

To estimate the value of R&D investment, consider its production



This diagram is based on Figure 3 in Zvi Griliches December 1990 AER paper, Patent Statistics as Economic Indicators

NSF Time Series of R&D Expenditure Data

- National Science Foundation Survey of Industrial R&D
  - Over 50 years of industry-level R&D expenditure data
  - Data on costs for employees, materials, and depreciation
  - Focus on R&D in physical and life sciences and engineering
- BEA-NSF collaboration on R&D satellite Account

Conceptual Challenges

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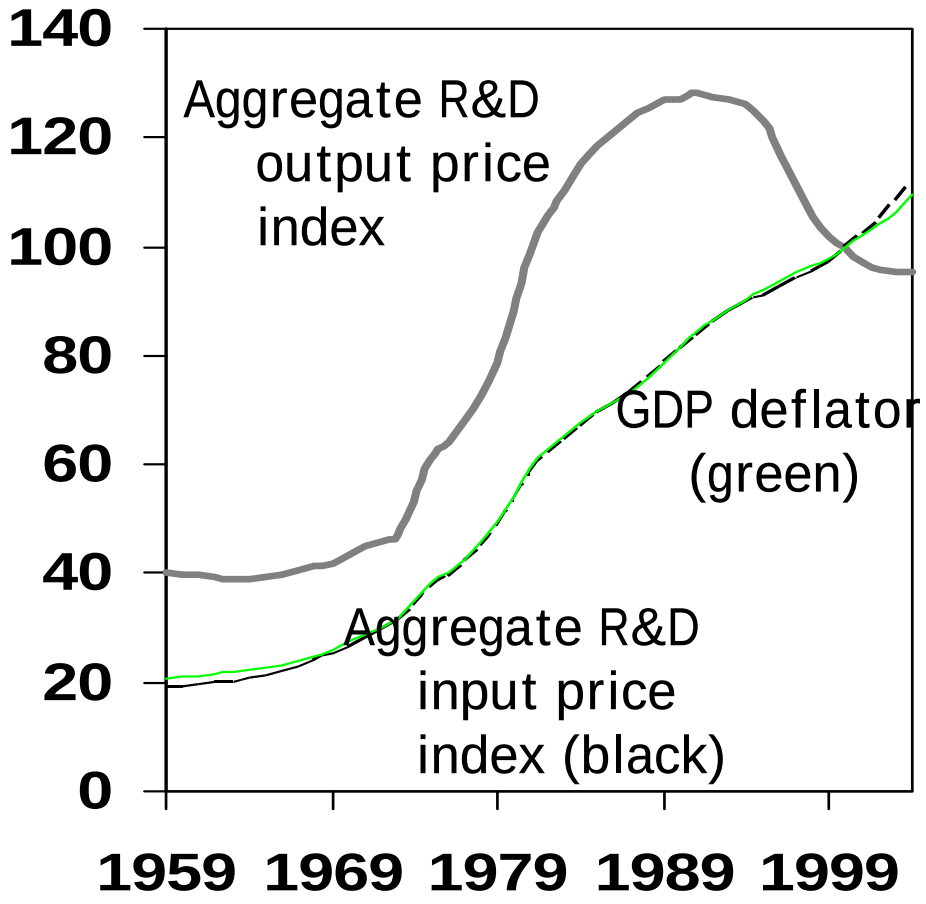
R&D Output Price Index Comparison

- Prior Practice for R&D deflation
  - GDP deflator
  - Price index based on R&D inputs
- Well known limitations
- Implementable alternatives:
- Aggregate R&D input price index
  - Weighted combination of input prices
  - Tracks with GDP deflator (green line)
- Aggregate R&D output price index
  - Uses BEA industry output prices, (based on BLS PPI)
  - Weighted by R&D investment by R&D intensive industries



Conceptual Challenges

- Definition of the unit of R&D output
- R&D output price index
- **Depreciation and obsolescence**
- Public goods qualities of R&D

Depreciation estimates for R&D assets

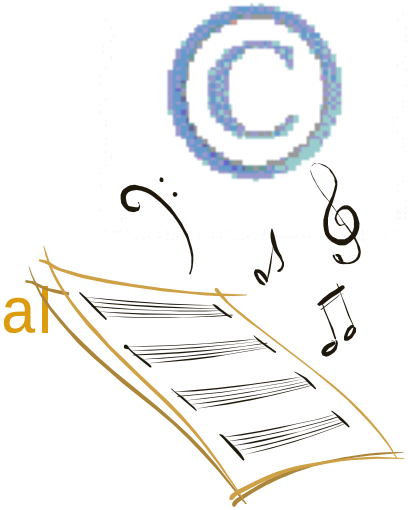
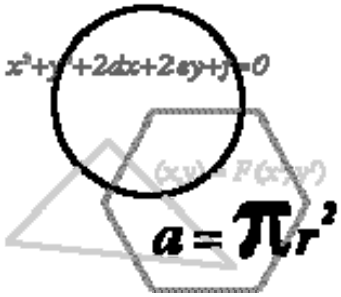
- Economic depreciation measures the value of the capital used up in production
  - Wear and tear for tangibles
  - Obsolescence and "leaking out" for intangibles

- Currently using averages from academic literature:
  - Chemical manufacturing, including pharmaceutical and medicine manufacturing: 11% per year
  - Transportation equipment manufacturing: 18% per year
  - Computer equipment manufacturing: 16.5% per year
  - All other industries, government, and non-profit R&D investment, including colleges and universities: 15% per year

Conceptual Challenges

- Definition of the unit of R&D output
- R&D output price index
- Depreciation and obsolescence
- **Public goods qualities of R&D**

Public Goods and Knowledge

	Excludable	Non-excludable
Rival	Private Goods  Fish Dinner	 Fishing grounds
Non-rival	 Intellectual Property	Public Goods  Geometry

Non-rivalry affects R&D within multi-unit firms

- How to value R&D shared between:
  - Units in different business segments
  - Units in different states
  - Units in different countries
- Preliminary discussions:
  - "The Treatment of International Research and Development as Investment," Daniel Yorgason
  - http://www.bea.gov/papers/pdf/yorgason_rd_paper.pdf
  - "Issues Related to treating R&D as investment in BEA's regional accounts," G. Andrew Bernat
    - http://www.bea.gov/papers/pdf/RegionalIssues.pdf

Overview of Estimation Method for R&D Stocks & GDP Impact

- Current dollar investment: sum input costs from NSF survey data
- Deflate current dollar investment
- Create capital stocks with perpetual inventory method: cumulative R&D investment less R&D depreciation
- For government and non-profit institutions: include a return to R&D
- Recalculate GDP and other macroeconomic variables

Results of 2007 R&D Satellite Account GDP, Saving, and Investment

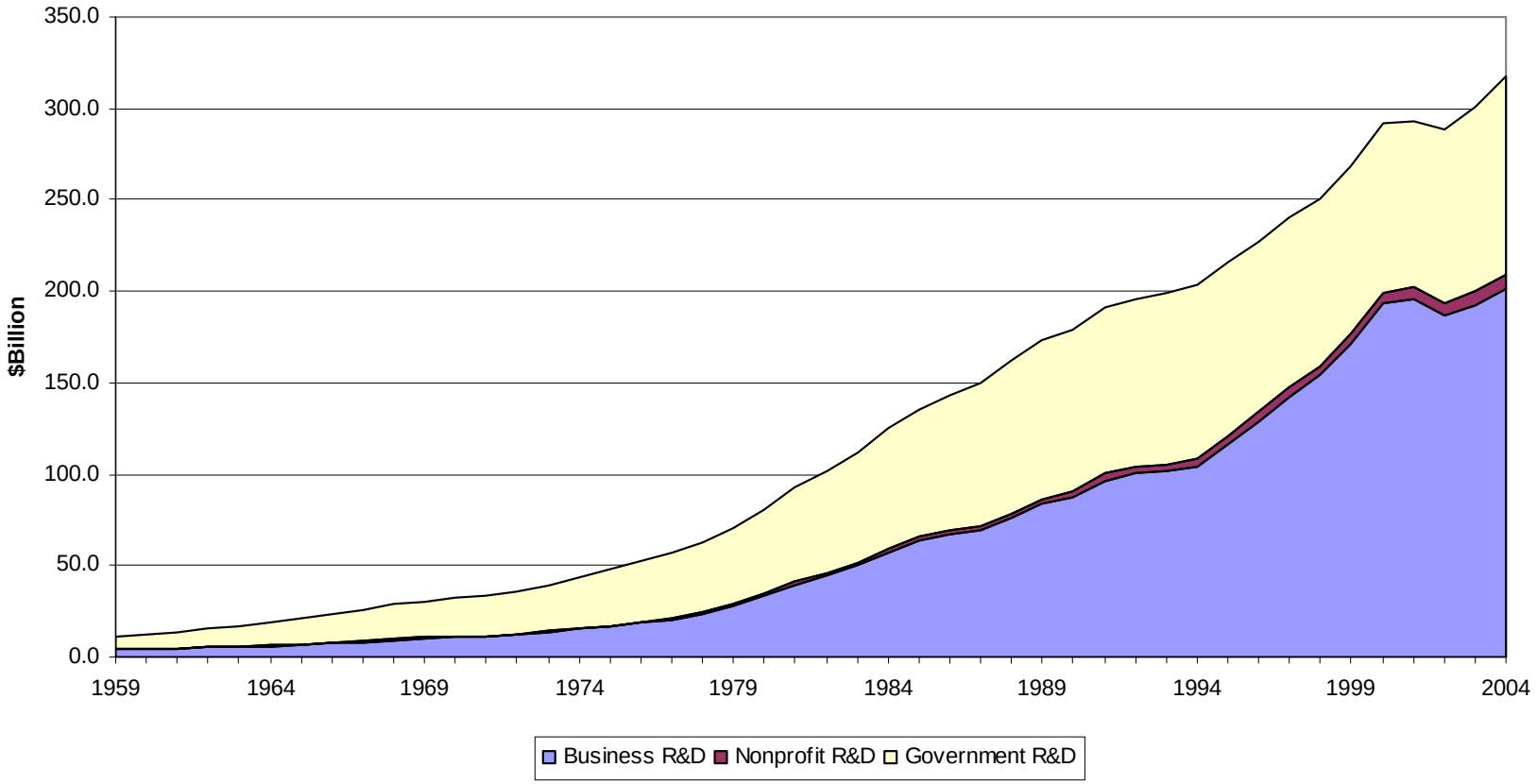
- Investment in R&D totaled $317 billion in 2004.
- Recognition of R&D as investment raises gross private domestic investment by 8.8 percent in 2004
- National saving rate rises by 2.0 percentage points from 13.8 percent to 15.8 percent in 2004
- Recognizing R&D as investment:
  - Increases GDP by an average of 2.9 percent per year between 1959 and 2004

current dollar

Results from BEA's 2007 R&D Satellite Account: Impact on Growth Rate and Share of Growth Rate

- More recently, the change in accounting treatment increases average real GDP growth rate from 3.2 to 3.3 between 1995 and 2004.
- Between 1995-2004, R&D's contribution to real GDP growth rate was 7 percent
  - In comparison, business investment in commercial and all other types of buildings accounted for just over 2 percent of real GDP growth.
  - R&D's contribution is almost as large as the contribution of computers in the existing GDP measure.
- Between 1959-2004, R&D accounted for 5 percent of real GDP growth rate

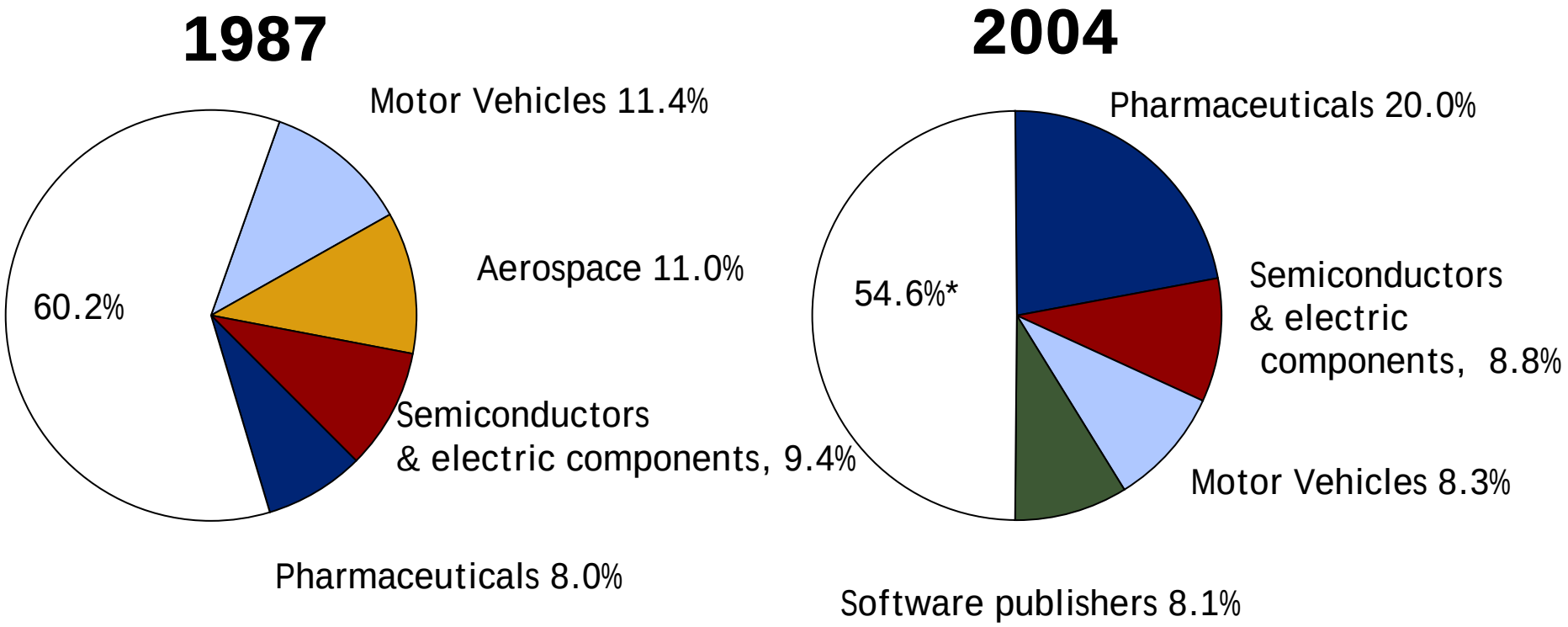
Addition to GDP from R&D Investment



current dollar

Top Four Private Business R&D-investing Industries

[% of Private Business Investment in R&D]



*Does not sum to 100% due to rounding errors

Industry Impacts: Average Percent Change in the Level of Value Added, 1987-2004

Pharmaceutical and medicine mfg	38.4
Chemicals minus pharmaceutical and medicine mfg	7.9
Computer and peripheral equipment mfg	29.8
Communications equipment mfg	22.1
Semiconductor and other electronic component mfg	25.7
Navigational, measuring, electro-medical, and control instruments mfg	12.2
Other computer and electronic products mfg	9.1

Motor vehicles, bodies and trailers, and parts mfg	14.5
Aerospace product and parts mfg	14.3
Other transportation equipment mfg	4.1
Software publishers	14.2
Computer systems design and related services	2.4
Scientific R&D services	12.7
All other industries	0.7

current dollar

Conclusion: What's Next?

- R&D in an Input-Output framework
- Regional and international aspects of R&D as investment
- Developing more timely indicators of R&D investment
- Prototype Innovation Account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Personal Income and Outlays
Corporate Profits
Fixed Assets
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International
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Trade in Goods and Services
International Services
International Investment Position
Operations of Multinational Companies
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GDP by State and Metropolitan Area
State and Local Area Personal Income
RIMS II Regional Input-Output Multipliers
BEA's Regional FACT Sheets (BEARFACTS)
BEA Economic Areas
View all Regional Accounts Information...
Industry
Access Industry Economic Accounts Data
Annual Industry Accounts
GDP by Industry
Input-Output Accounts
Benchmark Input-Output Accounts
Satellite Accounts
Research and Development
Travel and Tourism
Supplemental Estimates
View all Industry Accounts Information...
Search
Advanced | FAQ | A-Z Ind
Of Interest...
Explanatory Note: Supplemental GDP files
Updated: New SCB article from the 1980s added to Digital Library
Complete 2007 R&D documentation
Latest Estimates
Real GDP
• +0.6% in Q4 2007 (preliminary)
[Release: 2/28/08]
Personal Income
• +0.3% in January 2008
[Release: 2/29/08]
Int'l Trade in Goods and Services
• Decrease in the deficit
$4.4 billion to $58.8 billi
in December 2007(p).
Decrease in the deficit of
$46.9 billion to $711.6
Internet
100%

Research and Development Satellite Account

2007

- News Release: Research and Development
- *Survey of Current Business*: Research and Development Satellite Account Update. Estimates for 1959-2004: New Estimates for Industry, Regional, and International Accounts (PDF • 1,330 KB) Tables (PDF • 1,309 KB) | October 2007
- Report upon release, September 28, 2007 (PDF • 698 KB)
- 1959-2004 research and development data (Excel • 412 KB)
- Information Guide: Research and Development
- Background Papers
  - Methodology for R&D Capital Stocks and Net Rates of Return (PDF • 475 KB)
  - Framework for an Industry-based R&D Satellite Account (PDF • 143 KB)
  - 2007 R&D Satellite Account Methodologies: Current-dollar GDP Estimates (PDF • 1,082 KB)
  - Methodology for the Industry Estimates in the 2007 R&D Satellite Account (PDF • 1,449 KB)
  - Estimating Prices for R&D Investment in the 2007 R&D Satellite Account (PDF • 446 KB)
  - R&D Depreciation Rates in the 2007 R&D Satellite Account (PDF • 81 KB)
  - Treatment of International Research and Development as Investment (PDF • 986KB)
  - Issues Related to Treating R&D as Investment In BEA's Regional Accounts (PDF • 179KB)

Previously Published Estimates

Research and Development Conference, December 2006

- Measurement Issues and the R&D Satellite Account Methodology

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Government Current Receipts and Expenditures

- Government Current Receipts and Expenditures

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Closing Thoughts

Not everything that counts can be counted,
and not everything that can be counted counts.

Attributed to Albert Einstein

For more information:

http://www.bea.gov/industry/index.htm#satellite

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