Measuring R&D Globalisation: the U.S. Experience

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Presentation Summary

- Availability of R&D statistics from US surveys
- Data summary: Growth in international R&D investments
- Description of multi-agency data-linking project
- Technical process to accomplish the link
- Methodological findings
  - Sample frames
  - Data accuracy
- Analytical findings
- Data-linking feasibility conclusion

Available Survey Data – R&D in US

- National Science Foundation/Census Bureau BERD survey
  - R&D performance, funded by federal government and by non-federal sources of funds
    - (COMBINES domestic, foreign, affiliated, nonaffiliated, company, all other sources)
  - By industry,BAD, state, technology, type of R&D, etc.
  - Percent foreign ownership (recently added; not yet highest quality)

- Bureau of Economic Analyses Foreign Direct Investment in US (FDIUS) survey
  - R&D performed BY the affiliate of foreign parent
    - By industry of affiliate AND by country of Ultimate Beneficial Owner
    - For own account, for Federal Government and for others under contract (including foreign parent) **(benchmark years)**
  - R&D performed FOR the affiliate by others (benchmark years)

Available Survey Data – US R&D abroad

- National Science Foundation/Census Bureau BERD survey
  - R&D funding for performance outside the United States
    - By subsidiaries, affiliates and others based on company ownership
    - By country location of where the R&D is performed

- Bureau of Economic Analyses United States Investment Abroad (USDIA) survey
  - R&D performed BY the affiliate of US parent
    - By country, and by industry of affiliate and industry of US parent
    - For own account, for affiliated persons (including US parent), for others under contract **(benchmark years)**
  - R&D performed FOR the affiliate by others (including US parent) (benchmark years)

Available Survey Data –R&D Trade

- Bureau of Economic Analyses International Transactions
  - Import and Export Trade data (payments and receipts)
    - Business, professional and technical services
      - Research, development and testing (RDT) services (NOTE: This is for RDT services provided by all industries; not just by ISIC 73)
        - » Unaffiliated persons since 1992 (by country of trading partner)
        - » Affiliated persons since 2001 (by ownership category)

- NSF/Census Bureau BERD survey
  - R&D funding for performance outside the United States
    - By subsidiaries, affiliates and others based on company ownership
      - Purchases of RDT services (imports) “could” be a subset of R&D funding for performance abroad

Level of Industry R&D Performance: 2003

NSF/Census

- Total BERD (performed in U.S.) $204.0 billion
- Majority-owned U.S. affiliates of foreign companies (BERD special tabs) $ 17.1 billion
- Company-funded R&D performed by M-O affiliates outside the U.S. $ 24.1 billion

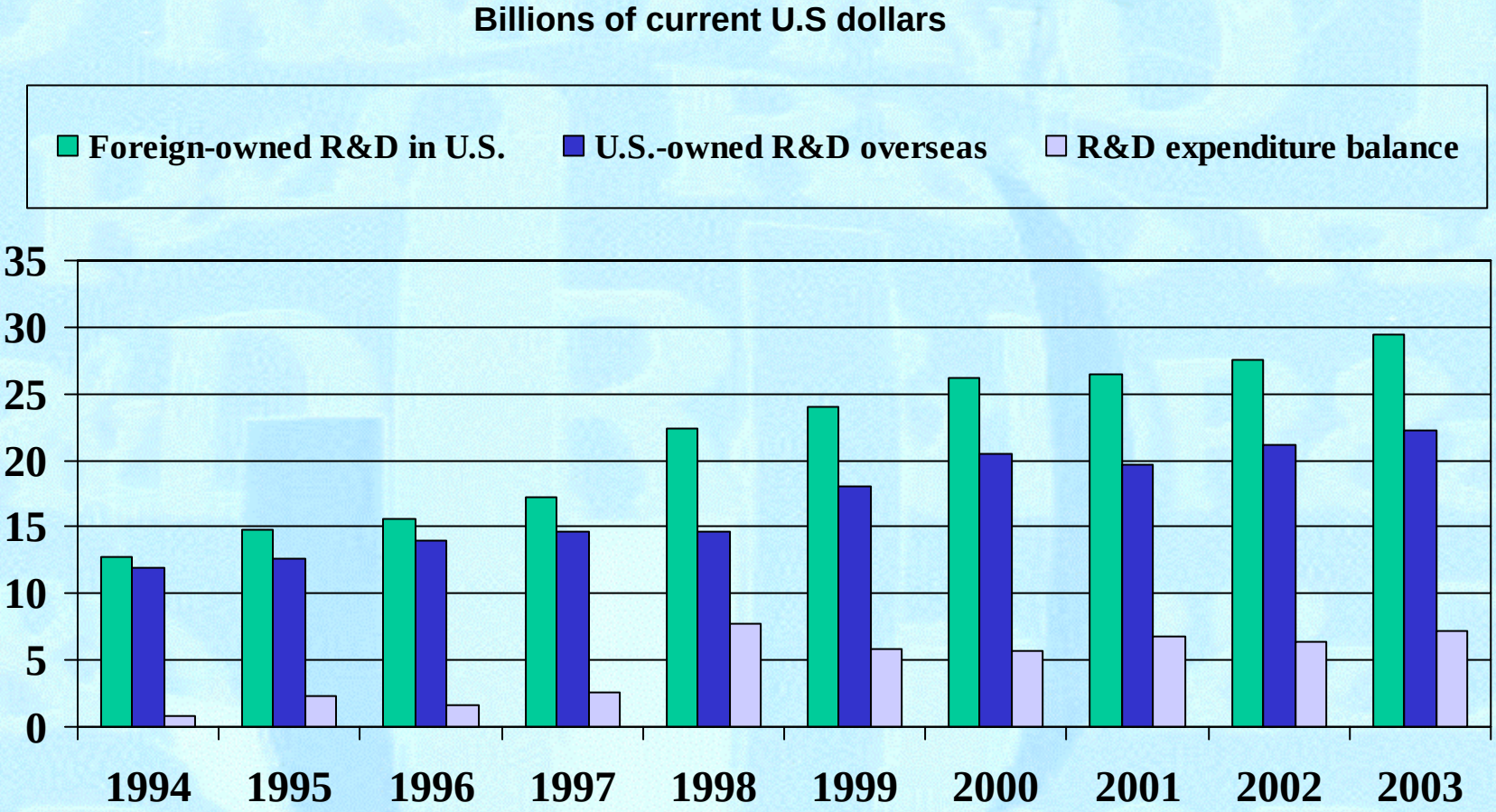
BEA

- U.S. parent companies (USDIA data) $140.1 billion
- Foreign M-O affiliates of U.S. parents $ 22.3 billion

- Majority-owned U.S. affiliates of foreign companies (FDIUS data) $ 29.5 billion

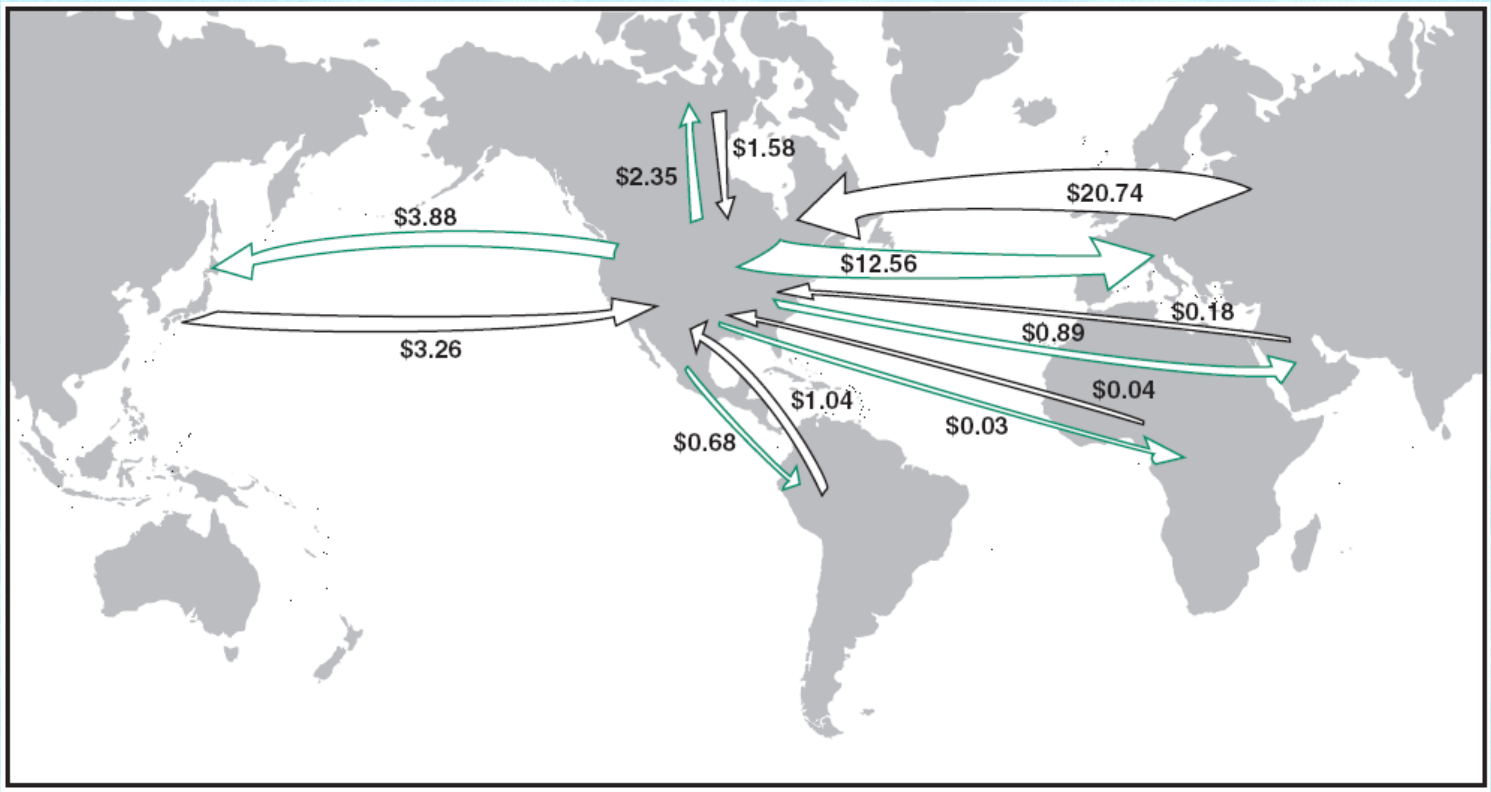
Sources: NSF, Survey of Industrial R&D, and BEA FDIUS and USDIA surveys

International R&D Performance on the Rise



Source: Bureau of Economic Analysis
Note:Foreign-owned R&D data for 1994-1996 based on funding.

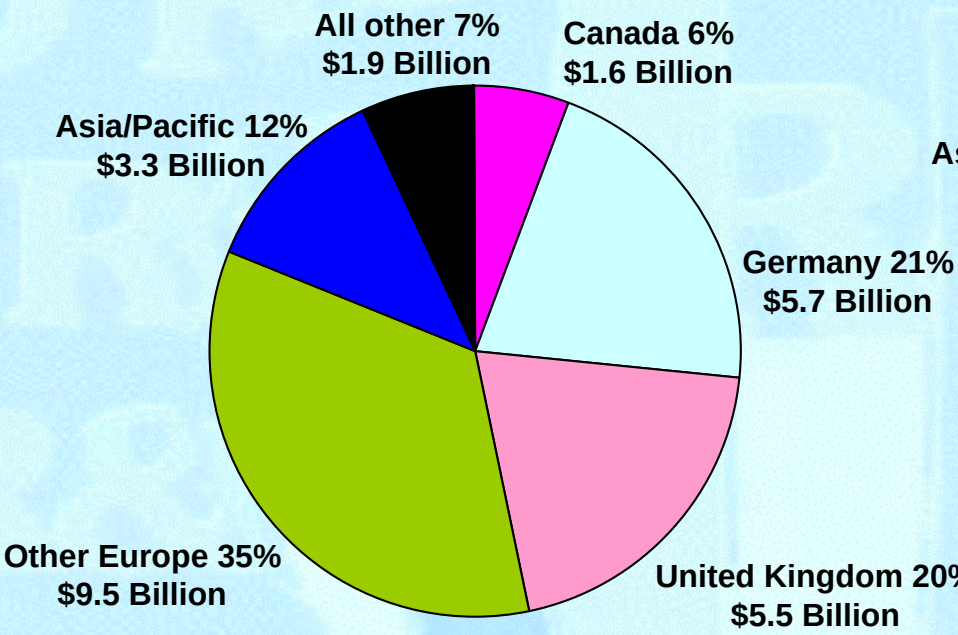
U.S.-Foreign Direct R&D “Investments”



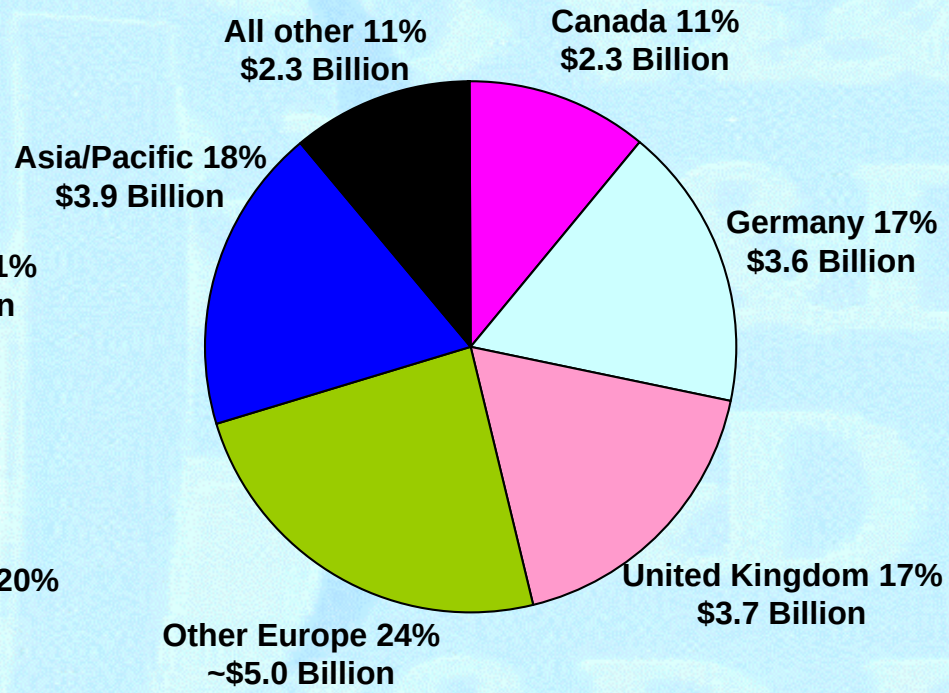
Source: Bureau of Economic Analysis

International R&D Investments, by Country: 2002

Foreign R&D in US ($27.5B)



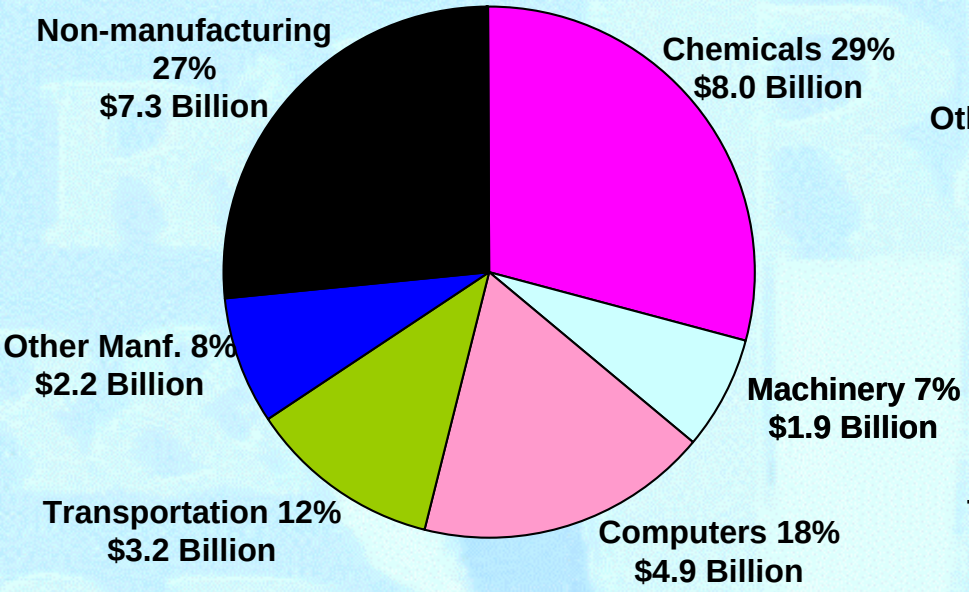
US MNE R&D Abroad ($21.2B)



Source: Bureau of Economic Analysis

International R&D Investments, by Industry: 2002

Foreign R&D in US ($27.5B)



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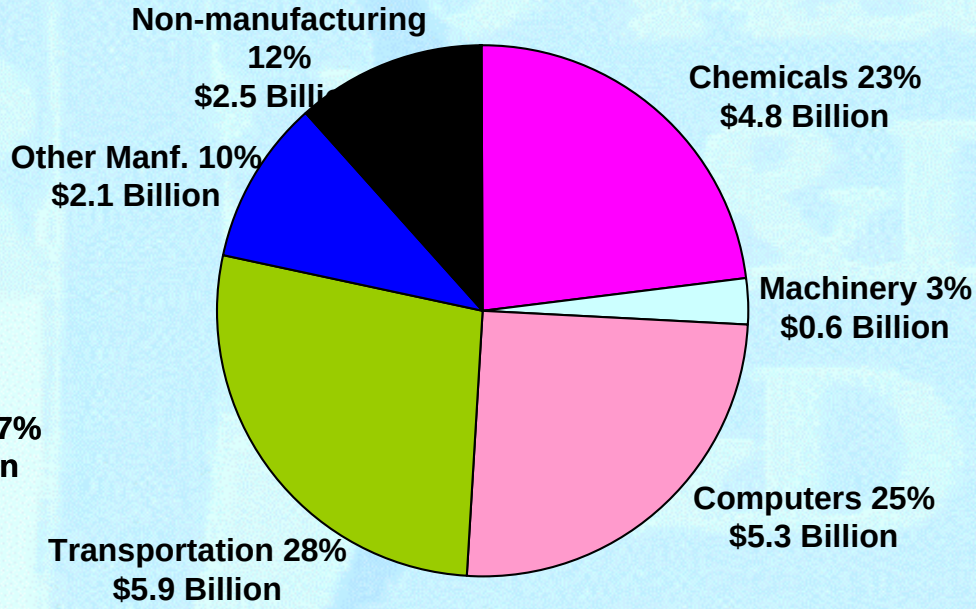

Source: Bureau of Economic Analysis

What is the U.S. Internationalisation of R&D Data Linking Project?

- Study to determine the feasibility of linking data from:
  - National Science Foundation/Census Bureau Survey of Industrial Research and Development (BERD data) with
  - Bureau of Economic Analysis direct investment surveys: U.S. affiliates of foreign companies (FDIUS data); and U.S. parents with foreign affiliates (USDIA data)
  - BEA trade surveys were not part of the linking project
- Years covered: Most recent BEA benchmark years
  - Foreign direct investment in the United States–1997
  - U.S. direct investment abroad–1999

Expected Link Outcomes

- Written report summarizing the research covering:
  - Comparability of data files, including definitions of respondents and data items
  - Quality of the matches
  - Types of tables that can be supported by the linked data set
  - Feasibility of moving link forward in time
  - Methodology for moving link forward
- Various analytical tabulations

Link Time Line

- Summer 2002: NSF proposed project.
- December 2002: Passage of Confidential Information Protection and Statistical Efficiency Act that allows such data sharing.
- July 2003: Memorandum of Understanding signed by NSF, BEA and Census authorizing the feasibility study.
- July–Dec. 2003: Site and staff security clearances required and obtained. Public notification of intent published.
- Early 2004: Linking activities began in earnest.
- Late 2004: Matching activities completed.
- Oct 2004–March 2005: Three agencies write the report.
- June 2005: Report released.
- February 2006: Agreement by three agencies to further matches(!)

3 Phases to Link

- Phase I: BEA data for U.S. affiliates of foreign MNEs from the 1997 benchmark survey linked to 1997 BERD data.
- Phase II: BEA data for the U.S. parent companies of U.S. MNEs from the 1999 benchmark survey linked to 1999 BERD data.
- Phase III: R&D data from the 1999 benchmark survey extracted for the majority-owned foreign affiliates of multi-unit U.S. parent companies that had matched to BERD in Phase II.

Some Link Specifics

Multiple steps:

- Computer match Employer Identification Numbers (EIN's) on BEA micro-data with companies in Census Bureau's Business Registers
- Match names, addresses and other identification information
- Merge Census ID number onto matched BEA records
- Match BEA records with BERD micro-data records
- Check consistency of data items common on BEA data to Census Bureau data

Good Coverage of Link

- Phase I: ~400 U.S. linked affiliates accounted for almost 80 percent of BEA's published 1997 total of $19.9 billion for the R&D spending by all U.S. affiliates

- Phase II: ~1,300 linked U.S. parents accounted for 92 percent of BEA's published 1999 total of $126.3 billion for the R&D spending by all U.S. parent companies

- Phase III: The majority-owned foreign affiliates of matched multi-unit U.S. parent companies accounted for 92 percent of BEA's published 1999 total of $18.2 billion for the R&D spending by all majority-owned foreign affiliates

Anticipated Statistical Benefits

- Improve Census Bureau (BERD) and BEA sample frames
- Improve quality of NSF/Census Bureau and BEA R&D data:
  - Erroneous or missing data
  - Industry classification
- Better understanding of issues affecting reporting
  - Definitions
  - Consolidation
  - Timing
  - Sampling

Identification of R&D Performers

- The Census Bureau added more than 500 companies not previously identified as having R&D activity to the 2003 BERD sample frame, based on the Phase I matches

- The Census Bureau added more than 60 companies not previously identified as having R&D activity to the 2004 BERD sample frame, based on the Phase II matches

Differences in Data Comparability

- In all three phases, cases were found in which Census Bureau and BEA R&D figures for the same company differed. The reasons for the differences were:
  - Subsidiary versus whole company reporting
  - Impact of company reorganizations and timing of surveys
  - Domestic performance versus worldwide reporting
  - Other respondent measurement error
  - Survey imputation error versus actual values reported

Anticipated Analytical Benefits

- Better understanding of the international dimensions of R&D performance in the U.S. and abroad
- Integrated data set on R&D performance and funding, with domestic and foreign ownership detail
- Enhanced information on the R&D activities of U.S. and foreign MNE's

Data Items Matched from BERD Survey
(Phase I)

- From NSF/Census BERD survey
  - R&D spending, by source and character
  - R&D employment
  - Sales
  - State location of R&D spending
  - Tabulations by industry

Data Items Matched for U.S. Affiliates of Foreign MNEs (Phase I)

- From FDI benchmark surveys
  - Total R&D spending by U.S. affiliates of foreign firms on a performance basis
  - R&D employment
  - Detail on for whom the R&D was performed
  - R&D performed for affiliates by others

Data Items Matched for U.S. Parents and Foreign Affiliates of U.S. MNE's

(Phases II and III)

From FDI benchmark surveys,

- For U.S. parent companies with R&D performing foreign affiliates:
  - Total R&D spending by U.S. parents and foreign affiliates on a performance basis
  - R&D employment
  - Sales
  - Tabulations by industry

Key Analytical Findings (1)

Phase I (U.S. affiliates of foreign companies)

For the matched majority-owned U.S. affiliates in 1997:

- The majority of the R&D expenditures by U.S. affiliates was devoted to development activities and was funded by company and other non-Federal sources
- U.S. affiliates accounted for 8 percent of the U.S. industrial R&D expenditures reported by companies covered by the BERD sample. The U.S. affiliate share of spending for basic research was twice as large (16 percent)
- U.S. affiliates employed 8 percent of the U.S. industrial R&D employees of companies in the SIRD sample

Key Analytical Findings (2)

Phase II (U.S. parent companies)

For the matched U.S. parents in 1999:

- U.S. parent companies accounted for 75 percent of the U.S. industrial R&D expenditures reported by companies included in the BERD sample
- U.S. parent companies accounted for about two-thirds of the R&D employees reported by companies included in the BERD sample
- In manufacturing, U.S. parent companies accounted for 86 percent of Federally-funded R&D expenditures reported by companies included in the BERD sample

Key Analytical Findings (3)

Phase III (Foreign affiliates of U.S. parent companies)

For majority-owned foreign affiliates of matched U.S. parents in 1999:

- About two-thirds of overseas R&D by majority-owned affiliates of matched parent companies was performed in five countries: United Kingdom, Germany, Canada, France, and Japan
- Among individual countries, R&D employees accounted for relatively high shares of total foreign affiliate employment in Japan, United Kingdom and Germany

Data-Linking Feasibility Conclusion

- The study unequivocally demonstrated that it is feasible to link micro-data from the BERD Survey to BEA's micro-data on U.S. affiliates of foreign MNEs and on U.S. parent MNEs.
- Since the linked data were somewhat dated—1997 and 1999—extensive analytical findings were not anticipated. Nonetheless, the study demonstrated the possibilities of exploring issues related to U.S. and foreign affiliates' R&D activities that previously were not possible.
- NSF, Census, and BEA are currently preparing next agreement to allow future (and possibly annual) links.
- Choose single year for inward and outward investments to allow analyses of integrated global R&D investments.

R&D Differences of U.S.- and Foreign-owned Firms: Future Links

- Single year for all three surveys (2003 or 2004)
- Industry-specific comparisons (KEY)
- U.S. state location (KEY)
- Type of research (basic research, applied research, development)
- Technology area (biotechnology, software etc.) Source of funding
- Type of R&D costs
- Use of collaborative and contract R&D