Developing a Regional R&D Satellite Account

BEA Advisory Committee Meeting

May 12, 2023
Presentation Goal: Seek Committee's Feedback

- Overall project
- Data and methodology
- Priorities and next steps
- Presentation of the new statistics
- Engagement with data users about these new data
Outline

• Motivation and background
• Methodological considerations and source data
• Preliminary results
• Next steps
Motivation

• R&D and other intangibles make a long-lasting contribution to the creation of economic output and economic growth

• BEA has partnered with the National Science Foundation (NSF) on two multiyear projects with the goal of better understanding the role of R&D in domestic production and global value chains

• This partnership follows a long tradition of close collaboration with NSF
A Brief History of BEA-NSF Collaboration

• R&D in BEA’s Economic Accounts
  – R&D satellite account (2004–2013) led to capitalization of R&D in BEA’s accounts
  – NSF-BEA MOU for early data releases (since 2013)
  – 2018 NIPA Comprehensive Revision
    • Reclassified R&D from software originals from own-account software to R&D
    • Recognized capital services in own-account investment in software and R&D
  – Regional R&D production and investment (2021 forward)

• Globalization
  – Microdata linking and survey data development related to MNEs (ongoing)
  – R&D in Supply Use Tables (SUTs/Extended SUTs)(2020 forward)
  – Trade in value added (2020 forward)
BEA-NSF Regional Collaboration

• Three-year agreement to develop a suite of state-level R&D statistics

• Goal: Measuring the regional distribution of R&D production and investment and its contribution to the regional economies
  
  – Improved measures of R&D output in BEA’s subnational GDP statistics
  
  – New regional statistics on private fixed investment and government gross investment
  
  – A step closer toward regional I-O accounts which would provide valuable insights into the participation of regional economies in global value chains

• The regional R&D satellite account builds on prior work with NSF on measures of national R&D investment
• BEA published first R&D satellite account in 1994 and introduced a revised account in 2006, which was later updated in 2007 and 2010

• Goal: Measuring R&D investment and examining the effects of capitalizing R&D in BEA’s economic accounts

• Focused on translating Frascati-based R&D expenditures to measures of economic activity within a national accounting framework
  – R&D gross output, investment, and capital stocks
  – R&D price deflators and depreciation rates
  – GDP impacts

• R&D was capitalized in BEA’s core economic accounts starting with the 2013 Comprehensive Revision of the NIPAs
Regional R&D Satellite Account

• Initial focus on R&D production for two main reasons:

  1. Better alignment with NSF’s data on R&D performance

  2. Broad interest in the economic contribution of the R&D sector
     • Presentation of national statistics on R&D value added, employment, and compensation
     • New state-level statistics on R&D production and R&D investment

• R&D production measures

  – *R&D value added*—the value that an industry generates as part of R&D production after it has accounted for its costs of energy, materials, and services used up in production

  – *R&D employment*—all full-time, part-time, and temporary wage and salary jobs in which workers are engaged in the production of R&D (researchers, R&D technicians, and other R&D supporting staff)

  – *R&D compensation*—the pay to employees (including wages and salaries and benefits such as employer contributions to pension and health funds) for their R&D-related work
Methodology Considerations and Source Data
Considerations

• R&D production (performance) and R&D investment (funding)
  – Sectoral distribution of R&D production
    • R&D performed by nonprofits largely funded by businesses or federal government
  – For R&D investment BEA assigns ownership to the funding sector
    • NSF reports R&D expenditures by source of funds
    • R&D government contracts and grants

• Geography: State
  – R&D can be performed in one state and used in multiple states
    • R&D production—location of R&D performance
    • R&D investment—location where R&D is used as a productive asset
General Approach

• BEA measures national R&D production in the detailed supply-use tables (SUTs), which show the industries that produce the R&D commodity and all uses of this commodity

• All data elements associated with R&D production in the core accounts are rearranged and combined using the GDP framework
  – R&D activity can be directly compared to GDP and to the economic activity generated by NAICS-defined sectors
  – Related measures of R&D employment and compensation

• Use state-level data to distribute R&D activity to the appropriate industries in each state
Methodology

Three main steps:

1. Identify the R&D-related commodities and use the R&D item-to-industry gross output ratios to obtain national values for R&D value added, employment, and compensation by R&D item and detailed industry

2. Identify source data on R&D with state detail from NSF and other sources, aligning definitions and concepts (e.g., own-account vs. purchased R&D)

3. Use state source data to distribute the national estimates of R&D value added, employment and compensation to states
## R&D Commodity Examples

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<tr>
<th>Industry</th>
<th>R&amp;D Commodity</th>
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<td>Pharmaceutical preparation manufacturing (325412)</td>
<td>For Sale Scientific Research and Development (taxable) Pharmaceutical and medicine manufacturing</td>
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<td>S&amp;L hospitals and health government services (99S112)</td>
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<td>Own Account Academic Scientific Research and Development (tax exempt) State and local government</td>
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<td>Colleges, Universities, Professional Schools, &amp; Junior Colleges (tax exempt) (61123N)</td>
<td>For Sale Academic Scientific Research and Development (tax exempt) Pharmaceutical and medicine manufacturing</td>
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## Primary Sources for State-level Data

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<th>R&amp;D Survey</th>
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<tr>
<td>Business Enterprise R&amp;D Survey</td>
<td>R&amp;D expenditures and R&amp;D employees of for-profit nonfarm businesses with 10 or more employees</td>
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<td>Higher Education R&amp;D Survey</td>
<td>R&amp;D expenditures at U.S. colleges and universities that expended at least $150,000 in separately accounted for R&amp;D in the fiscal year</td>
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<td>Federally Funded R&amp;D Centers (FFRDCs) Survey</td>
<td>R&amp;D expenditures at FFRDCs</td>
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<td>Survey of State Government R&amp;D</td>
<td>R&amp;D activity performed and funded by departments and agencies in each of the nation's 50 states, the District of Columbia, and Puerto Rico</td>
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<tr>
<td>Federal Funds for R&amp;D Survey</td>
<td>R&amp;D activity performed and funded by federal agencies</td>
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<tr>
<td>Survey of Nonprofit Research Activities</td>
<td>R&amp;D performed by 501(c) nonprofit organizations</td>
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</table>
Primary Sources for State-level Data

Other Sources

• Economic Census, Census Bureau

• Quarterly Census of Employment and Wages, Bureau of Labor Statistics

• American Community Survey, Census Bureau

• BEA regional data on compensation and employment
Data Challenges

• For the business sector state-level employment data is lacking relative to R&D expenditures
  – NSF started publishing state R&D employment data with BERD 2017

• Company-to-establishment adjustment
  – R&D survey data are collected on a company basis whereas BEA’s industry I-O accounts are prepared on an establishment basis
    • Company-based approach: All of a multiunit company's R&D expenditures are assigned to one industry
    • Establishment-based approach: An establishment’s R&D expenditures are assigned to the industry most closely related with that activity
  – This adjustment is even more critical to the development of the regional R&D statistics
Value added and compensation

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- **Own account R&D**
  - State allocator series for each R&D item developed using primarily R&D expenditure data from R&D surveys

- **For sale R&D**
  - State allocator series developed from the difference between R&D performance by state and own-account R&D by state
Employment

• Business sector and federal government
  – QCEW overall employment data by industry and state
  – ACS state-level data on occupations by industry
  – NSCG data on occupations with R&D as primary work activity

• Nonprofit sector and government (higher education)
  – HERD
A First Look at Preliminary Estimates in the Regional R&DSA
R&D Value Added as a Share of GDP

State R&D VA as a share of state GDP, 2020
[percent]

U.S. Bureau of Economic Analysis
R&D Share of State Compensation

State R&D compensation as a share of state compensation, 2020 [percent]

US value = 2.6
Max: New Hampshire = 6.3
Min: Wyoming = 0.4

U.S. Bureau of Economic Analysis
State Distribution of R&D Production

State share of U.S. R&D VA, 2020
[percent]
Top 5 R&D Performing States

Composition of state R&D VA by R&D performing sector, 2020

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<th>State</th>
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<th>Nonprofits</th>
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<td>New York</td>
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<td>Washington</td>
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Business, Nonprofits, Government
Top Semiconductor Manufacturing R&D States

Semiconductor manufacturing R&D VA nominal trends
[2012=100]
What’s Next?

• Year 1: Preliminary state-level estimates of R&D value added, employment, and compensation, 2012–2020

• Year 2: Improve and refine the initial estimates
  – Incorporate new data, including microdata and special tabulations of R&D surveys from the Census Bureau
  – Focus on employment measurement, where less data is available
  – Disseminate the statistics for public comment

• Year 3 and beyond
  – Continue to refine and update the production statistics
  – Develop state-level R&D investment measures
  – Assess the feasibility of quarterly and sub-state statistics
## Proposed Data Presentation

![BEA Logo](https://www.bea.gov/)

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<td>Motor vehicles, bodies and trailers, and parts manufacturing</td>
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Feedback and Discussion

• General thoughts about the project?

• Feedback on data and methodology?

• How should BEA prioritize work next?

• Should BEA present the statistics with a focus on R&D-intensive industries as proposed or some other way?

• What can BEA do to inform the data users on the usefulness of these new data?