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's First R&D Satellite Account

- 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

Industry	R&D Commodity
Pharmaceutical preparation manufacturing (325412)	For Sale Scientific Research and Development (taxable) Pharmaceutical and medicine manufacturing
	Own Account Scientific Research and Development (taxable) Pharmaceutical and medicine manufacturing
Research and Development (taxable) (54170P)	For Sale Scientific Research and Development (taxable) Pharmaceutical and medicine manufacturing
	Own Account Scientific Research and Development (taxable) Scientific R&D services
Auxiliary Research and Development (54170A)	For Sale Auxiliary Scientific Research and Development (taxable) Pharmaceutical and medicine manufacturing
S&L hospitals and health government services (99S112)	For Sale Scientific Research and Development (tax exempt) Pharmaceutical and medicine manufacturing
	Own Account Scientific Research and Development (tax exempt) State and local government
Public education beyond high school government services (99S022)	For Sale Academic Scientific Research and Development (tax exempt) Pharmaceutical and medicine manufacturing
	Own Account Academic Scientific Research and Development (tax exempt) State and local government
Colleges, Universities, Professional Schools, & Junior Colleges (tax exempt) (61123N)	For Sale Academic Scientific Research and Development (tax exempt) Pharmaceutical and medicine manufacturing
	Own Account Academic Scientific Research and Development (tax exempt)
Hospitals (tax exempt) (62200N)	For Sale Scientific Research and Development (tax exempt) Pharmaceutical and medicine manufacturing
	Own Account Scientific Research and Development (tax exempt)

Business

Government

Nonprofit

Primary Sources for State-level Data

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

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

Preliminary State Methodology

Value added and compensation

Compensation Share of Value Added (National Level)	2012	2013	2014	2015	2016	2017	2018	2019	2020
Research and development	**0.61**	**0.61**	**0.61**	**0.61**	**0.62**	**0.64**	**0.63**	**0.63**	**0.63**
Business	0.58	0.57	0.57	0.58	0.59	0.61	0.60	0.61	0.59
Manufacturing	0.42	0.41	0.41	0.41	0.44	0.48	0.47	0.48	0.44
Nonmanufacturing	0.71	0.70	0.70	0.71	0.70	0.69	0.68	0.68	0.67
Nonprofit institutions serving households	0.62	0.63	0.64	0.63	0.65	0.64	0.64	0.66	0.73
Government	0.72	0.74	0.74	0.72	0.75	0.76	0.74	0.74	0.79

- 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

Preliminary State Methodology

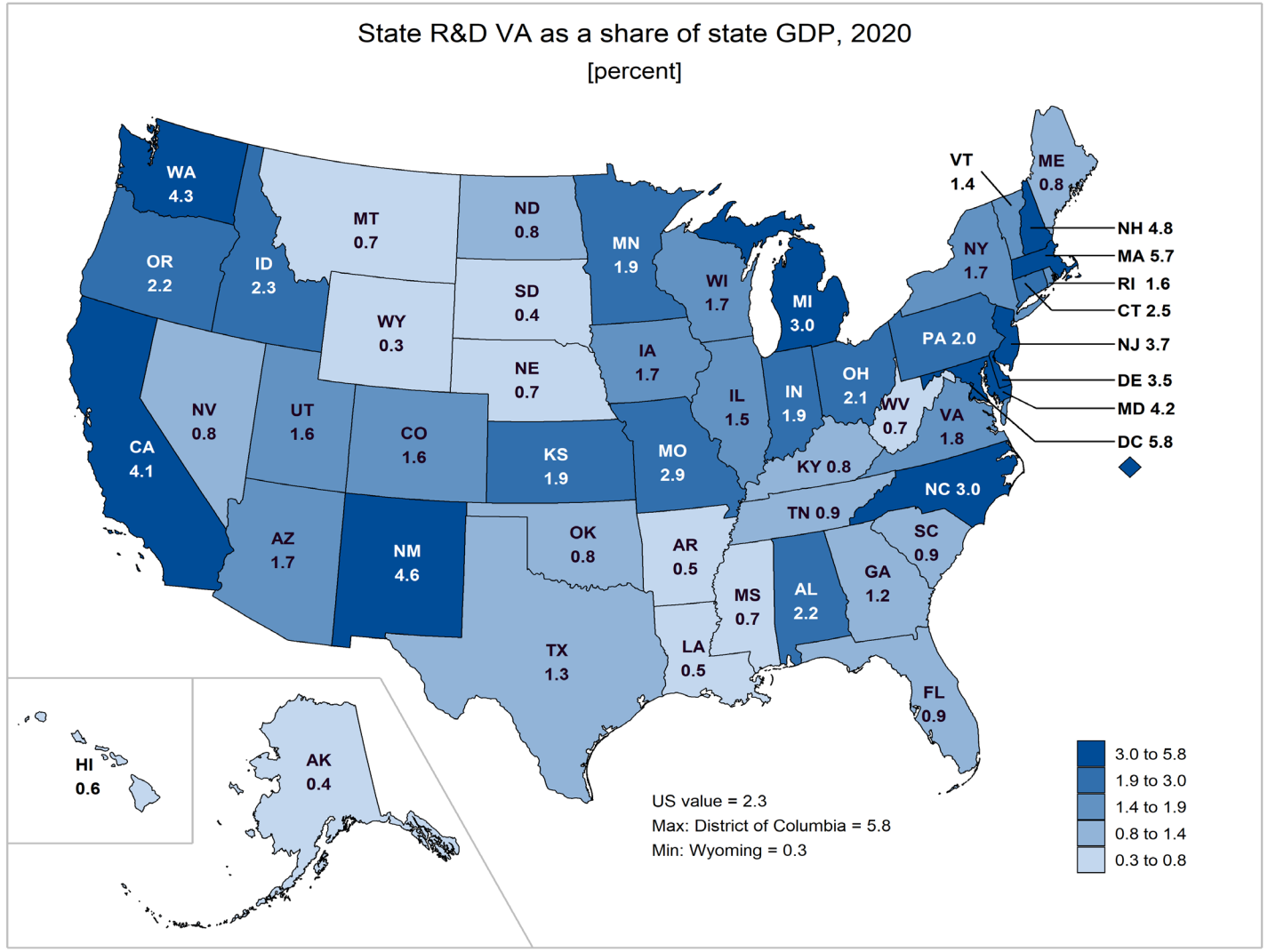
Employment

- 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

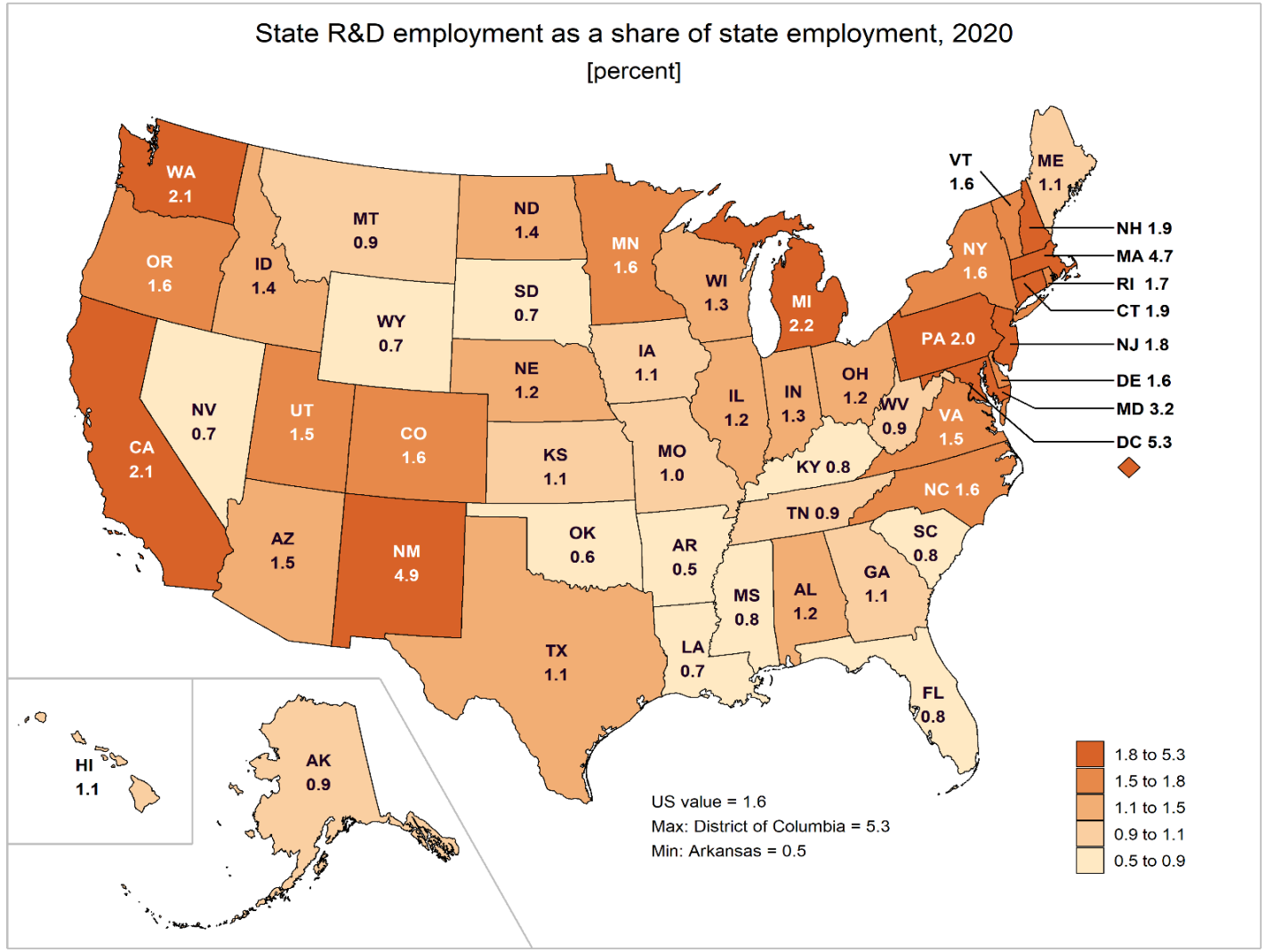
A First Look at Preliminary Estimates in the Regional R&DSA

R&D Value Added as a Share of GDP



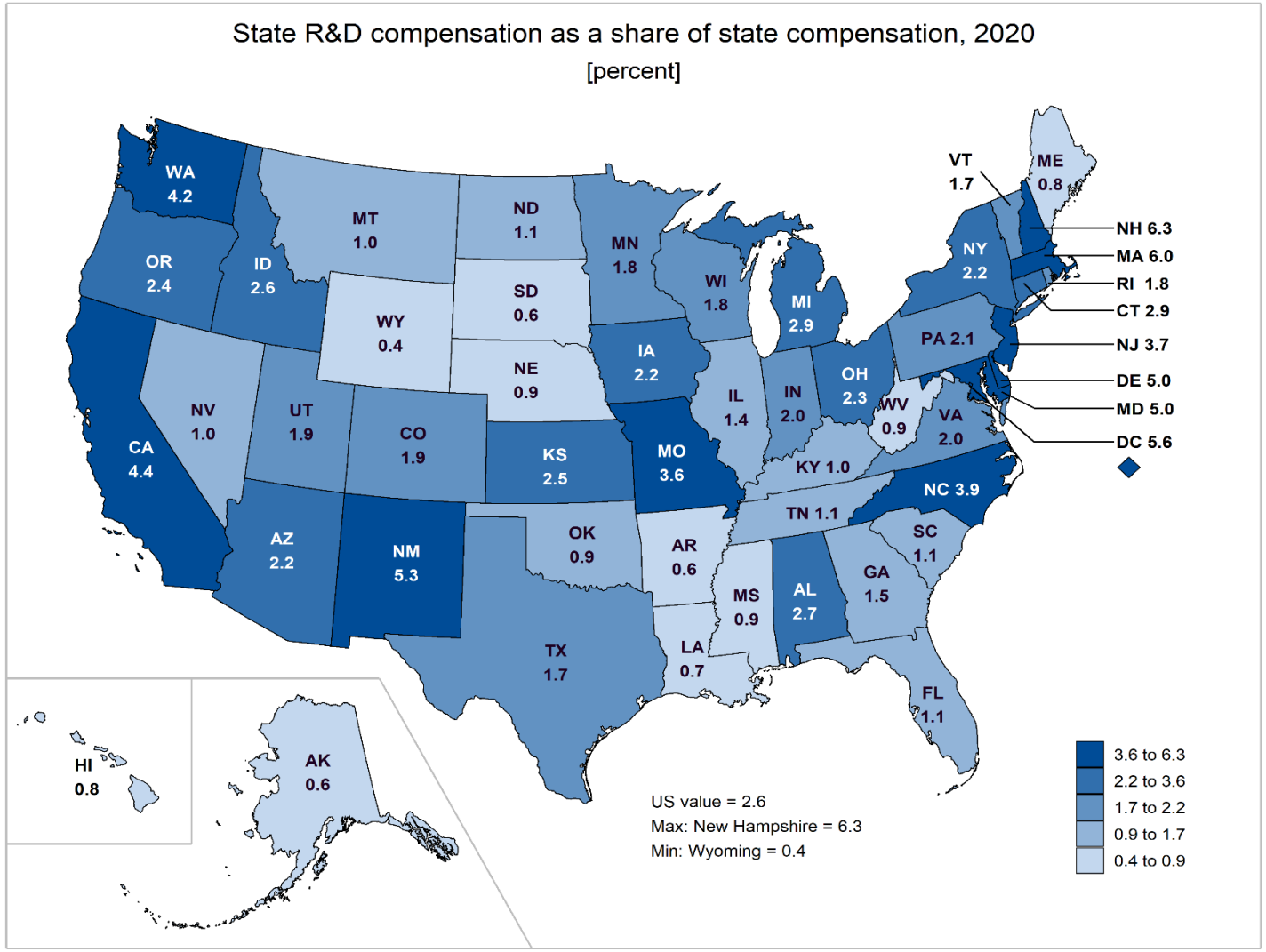
U.S. Bureau of Economic Analysis

R&D Share of State Employment



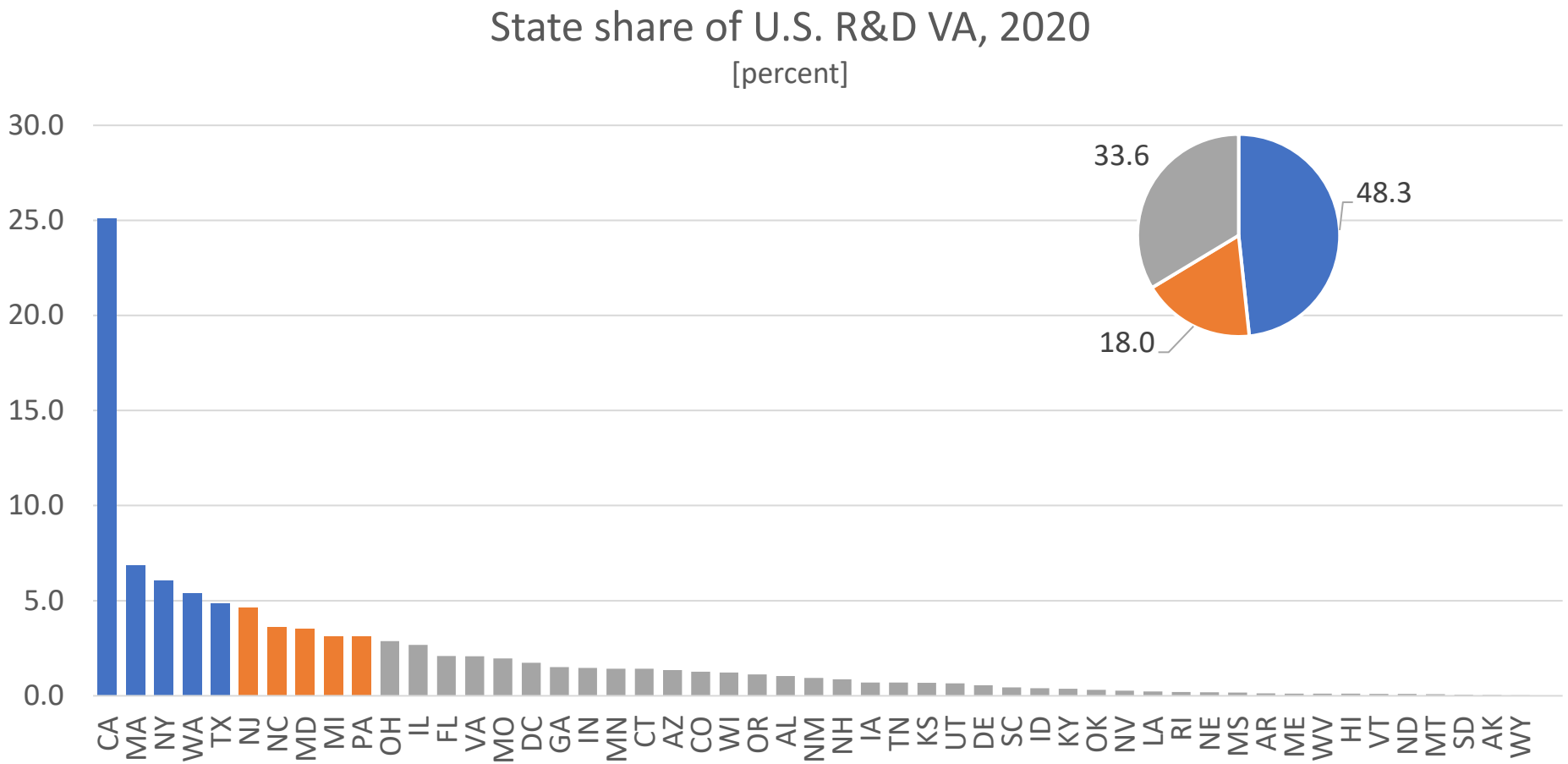
U.S. Bureau of Economic Analysis

R&D Share of State Compensation

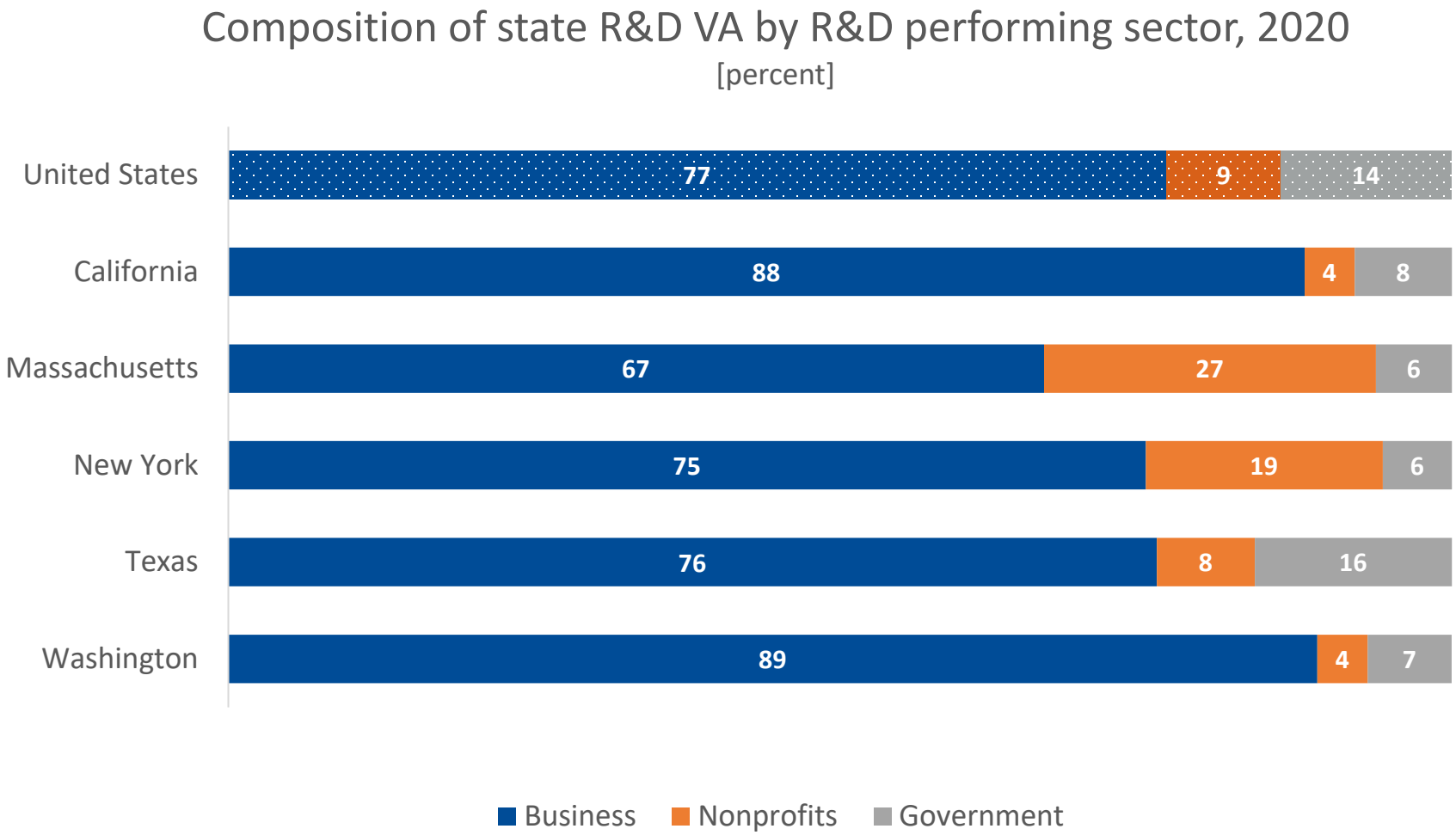


U.S. Bureau of Economic Analysis

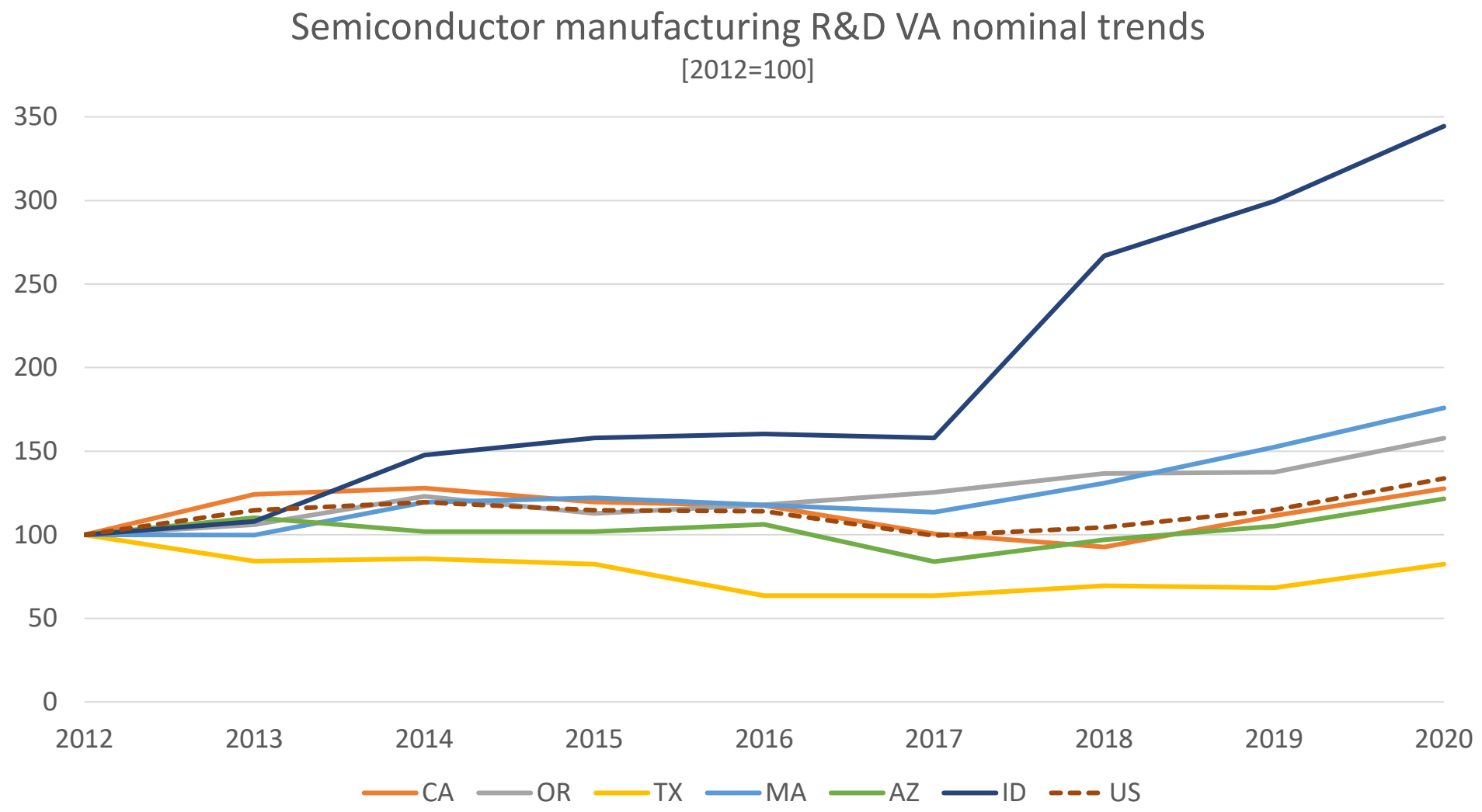
State Distribution of R&D Production



Top 5 R&D Performing States



Top Semiconductor Manufacturing R&D States



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

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Research and development									
Business									
Manufacturing									
Pharmaceutical and medicine manufacturing									
Chemical manufacturing, excluding pharmaceutical and medicine									
Semiconductor and other electronic component manufacturing									
Other computer and electronic product manufacturing									
Motor vehicles, bodies and trailers, and parts manufacturing									
Aerospace products and parts manufacturing									
Other manufacturing									
Nonmanufacturing									
Scientific research and development services									
Software publishers									
Financial and real estate services									
Computer systems design and related services									
Other nonmanufacturing									
Nonprofit institutions serving households									
Universities and colleges									
Other nonprofit institutions									
Government									
Federal									
National defense									
Nondefense									
State and local									

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?