Measuring Innovation: Building a Data Infrastructure

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Why Include Innovation in Our System of Economic Measurement?

- Driver of Improved Living Standards

- Debate about the rate of innovation

- Impact of Innovation on labor markets

- Evidenced-Based Policy can address problems uncovered with data

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What Should We Measure?

- Inputs to "Innovative" Activity
  - Labor (including training)
  - Capital
- Outcomes from "Innovative" Activity
  - Ultimate Outcomes: Productivity, Wages, Living Standards
  - Intermediate Outcomes: Patents, New Products, Economic Dynamism
- Efficiency of Investments in "Innovative" Activity
  - Role of Institutions

Framework for Measurement

- Focus on where Innovation occurs: **Firms** and **Universities**
- Focus on who does the Innovating: **Employees** of firms and universities, especially **Scientists** and **Engineers**
- Track investments in Innovative Activity at the firm and university (or lower) level
- Track flow of innovation inputs and IP across firms and universities
- Track reallocation of resources from lower valued to higher valued (more innovative?) uses.
  - **Measuring Innovation = Measuring Economic Dynamism**

So, How Do We Measure All This?

Not with a Survey.

You must Break Down Information Silos and Use Linked Administrative and Survey Data like in Jarmin (JEP 2019)

Build on a Base of Near Universe Longitudinal Micro Data on Firms, Establishments and Workers

- Ability to measure business and labor market dynamics has improved dramatically in last two decades.

- Business Dynamics:
  - Census: Longitudinal Business Database (LBD) / Business Dynamics Statistics (BDS) / SynLBD @ Cornell Virtual RDC
  - BLS: Quarterly Census of Employment and Wages (QCEW) / Business Employment Dynamics (BED)

- Labor Market Dynamics:
  - Census: Longitudinal Employer Household Dynamics (LEHD) program (QWI and OnTheMap)
 - BLS: Job Openings and Labor Turnover Survey (JOLTS)

Why is this a sensible thing to do?

- This is where a lot of the impacts (e.g., birth/death, growth, employment, wages) we're interested in are manifested.
- **Universe coverage** of firms and workers means we can find "rare" impacts that surveys typically miss.
- **Universe coverage** makes linkage to other data sources more productive (e.g., have population controls)
- Data are based on administrative records and are "inexpensive" both in terms of resources and public burden.

Basic Facts on Dynamism

- Businesses

Figure 1: Annual Firm Startup and Exit Rates, U.S. Private Non-Farm Sector, 1981-2013
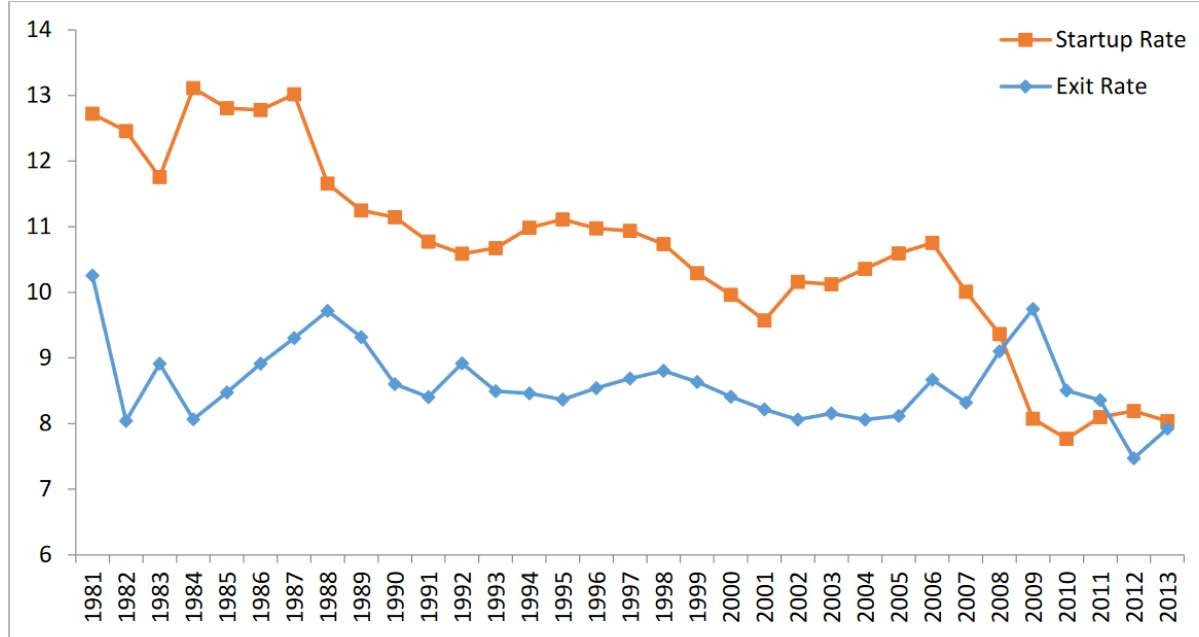
Note: Startup rate is the number of new firms divided by all firms. Exit rate is number of exiting firms divided by all firms. Startups are new legal entities with all new establishments. Exits are legal entities that cease to exist with all establishments shutting down. Data from Business Dynamics Statistics.

- Labor Market

Figure 1: Hires and Separations
1995:Q4 – 2012:Q3, LEHD, JOLTS, and CPS Quarterly Data
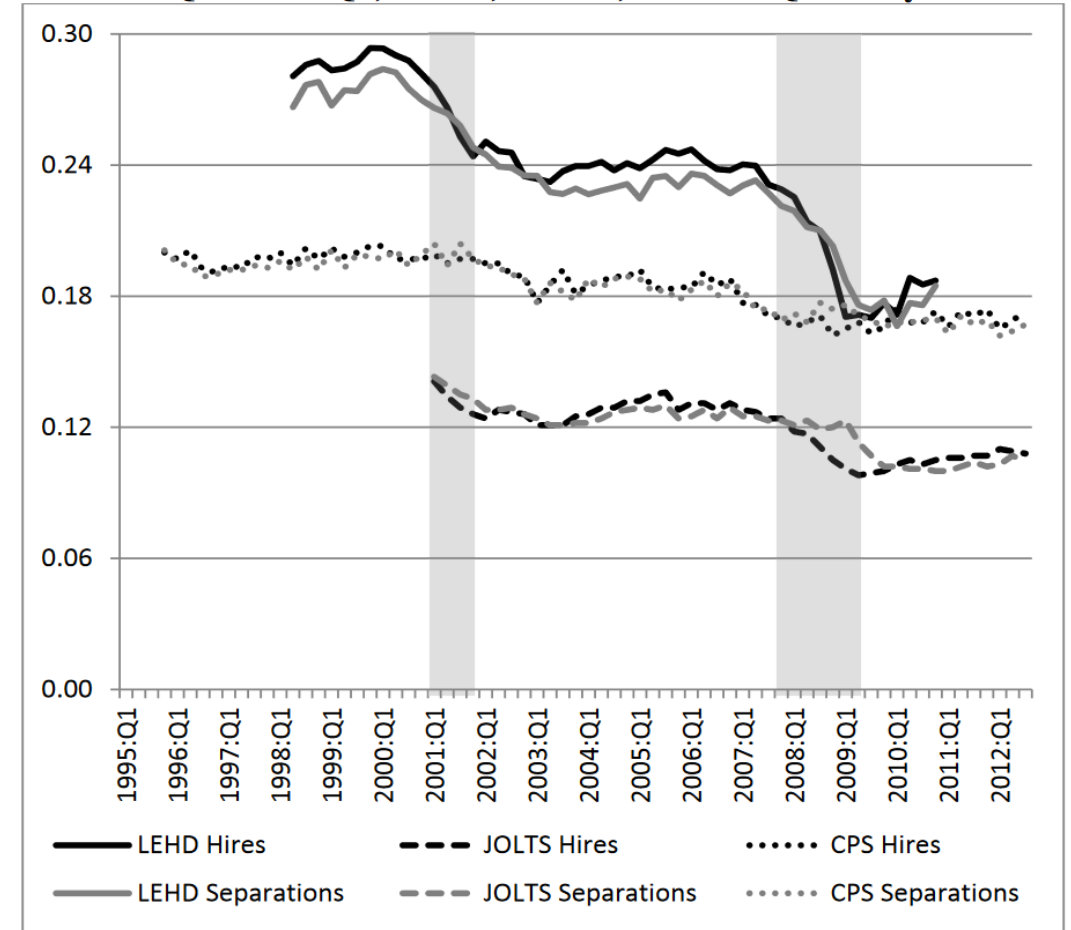
Notes: LEHD data for 30 states were downloaded from the Cornell Virtual RDC. JOLTS national monthly data were downloaded from the BLS website and converted to a quarterly frequency. CPS national monthly data were downloaded from the Federal Reserve website and converted to a quarterly frequency. All data are seasonally adjusted.

Innovation, Creative Destruction and Economic Dynamism

- Productivity improves as resources are reallocated from less valued to more valued uses
- Innovation introduces shocks that induce reallocation – aka **entrepreneurship**
- Frictions can slow reallocation
- Is slowing productivity growth the result of reduced innovation (shocks) or increased frictions (reduced responsiveness to shocks?
- Decker, Haltiwanger, Jarmin and Miranda (2018) find evidence for the latter

Survey Data Adds Critical Covariates

- Productivity (firm and estab survey data)

- Demographic characteristics (from household surveys)

- R&D (from business surveys)

- Management practices (business surveys)

"Structured Management" practices are associated with significantly better performance. (Bloom et. al. forthcoming AER).

Management score decile
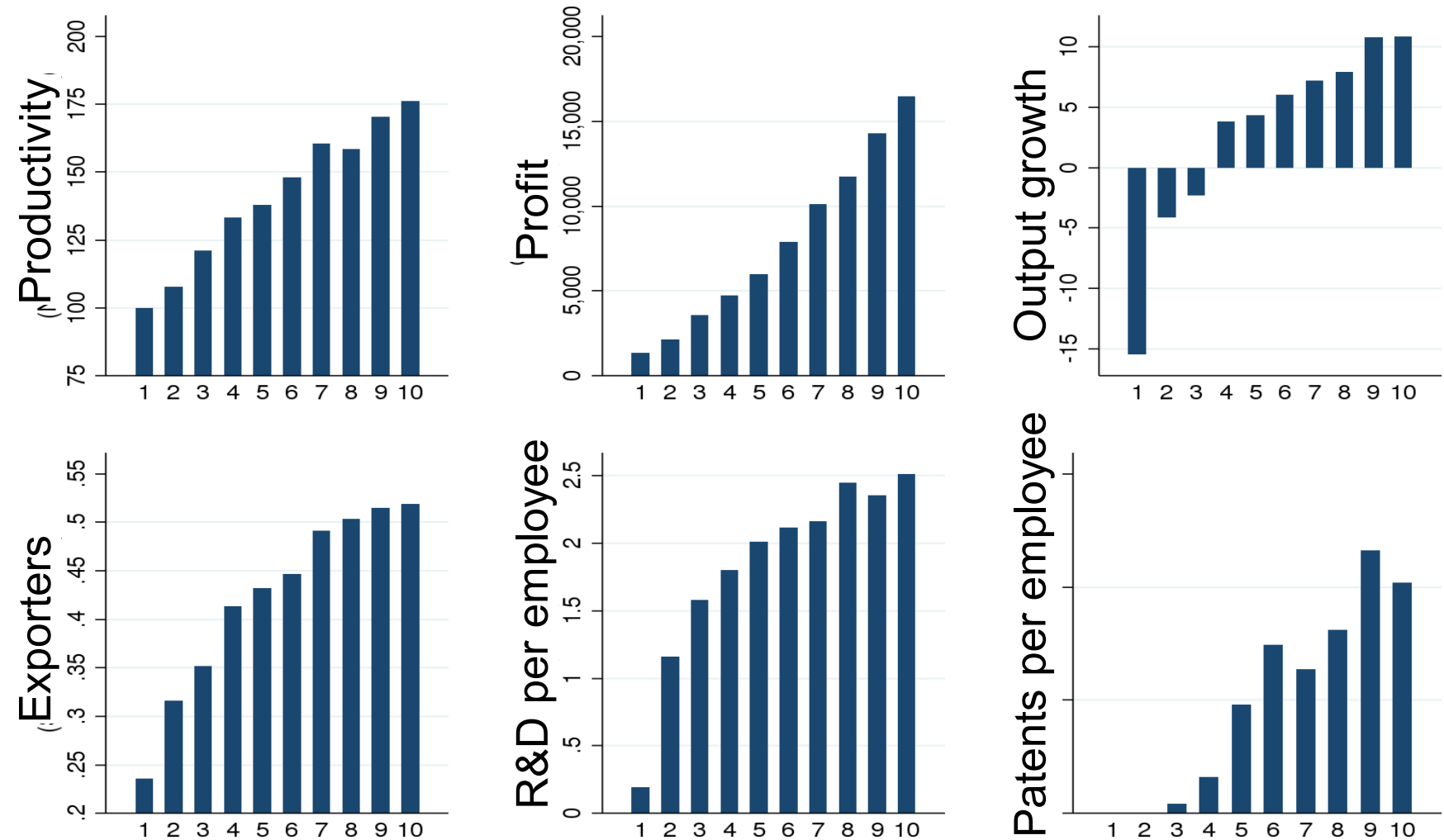
Ongoing Enhancements

- Link LBD to Patent Data
  - Academic researchers have linked Census microdata to patent data for research and policy analysis (e.g., Acemoglu, Akcigit, Bloom and Kerr (2018))
  - Census and USPTO undertaking project to more systematically link LBD and patent data to produce regular enhanced BDS statistics
- Link LBD to transactions level trade data - LFTTD
- National Job-to-Job Flows
  - Building national data system from state level infrastructure in LEHD
- Link Self-Employed to LEHD infrastructure
- Projects supported by Census developmental seed investments

University Administrative Data

- Innovation Measurement Initiative
  - Data on all sponsored research
  - All spending included
  - Labor split by faculty, students, staff
  - Partnership with University of Michigan IRIS

- Post-Secondary Employment Outcomes
  - Transcript data linked to LEHD
  - Better worker level data on human capital investment
  - New data products on earnings outcomes for graduates that aid students and parents.

IRIS INSTITUTE FOR RESEARCH ON INNOVATION & SCIENCE
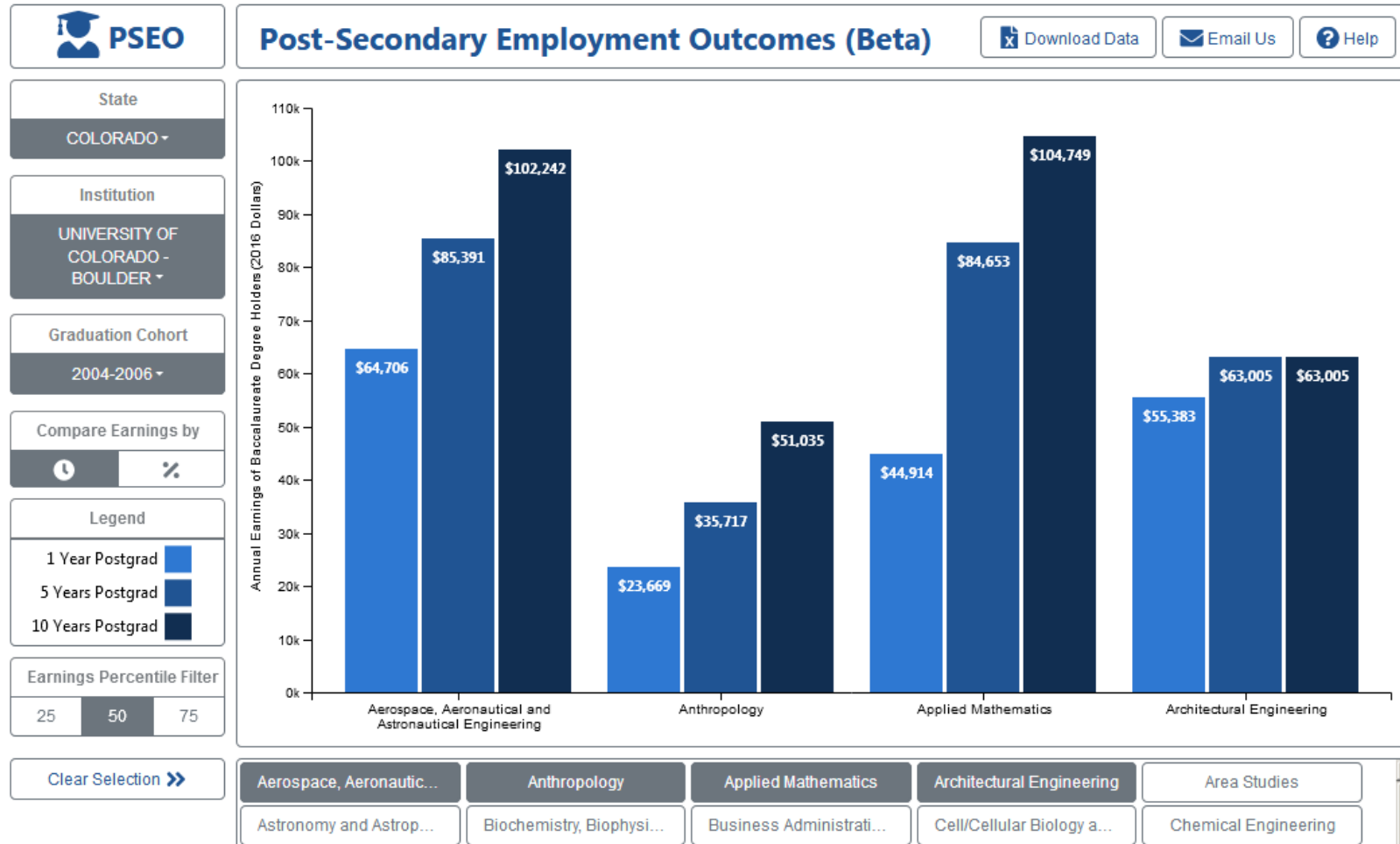
Innovation Measurement Initiative

- Collaborative research project between Census and researchers from several universities

- Integrates university administrative data on federally funded research grants with Census Bureau data assets

- Produce statistics consistent with the Census's economic and social measurement mission **and directly relevant to the data providers**
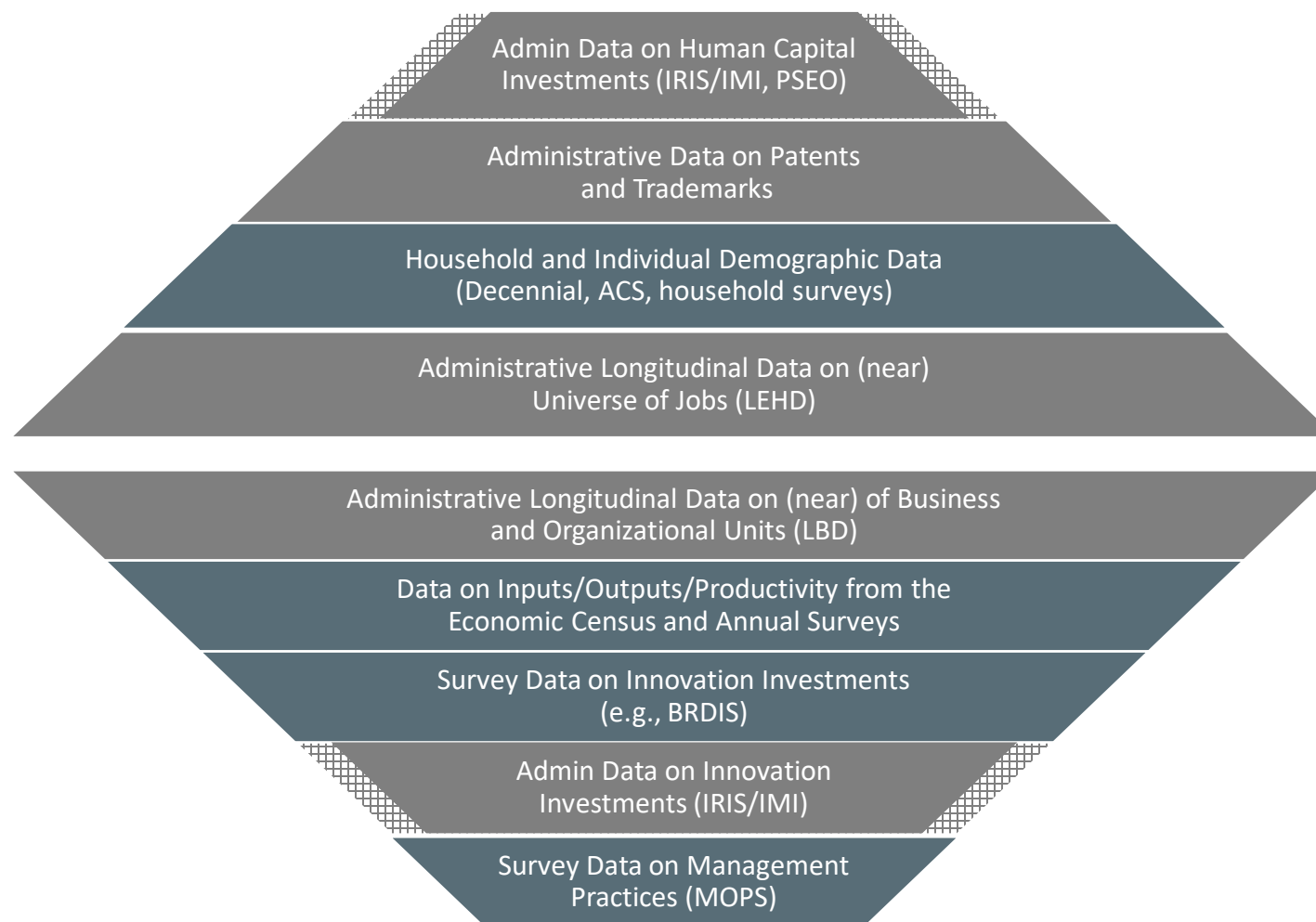
Post-Secondary Employment Outcomes (PSEO)

- The PSEO provides:
  - Improved human capital measurement for workers in LEHD
  - New public-use statistics:
    - 25th, 50th, and 75th percentiles of annual earnings for college and university graduates
    - Employment by industry and region of the country (scheduled for future release)
    - By degree level, degree major, and post-secondary institution
    - One year, five years, and 10 years after graduation.

- Currently partnering with Census for the PSEO pilot are:
  - The University of Texas system, Colorado Department of Higher Education (all public two- and four-year institutions in Colorado), University of Michigan, Ann Arbor; University of Wisconsin, Madison.

- Currently in talks to expand PSEO to:
  - Ohio Department of Higher Ed, State Council of Higher Education for Virginia, Texas Higher Education Coordinating Board, Arizona Board of Regents, Pennsylvania State System of Higher Education, Louisiana Board of Regents, New York SUNY and CUNY systems, Indiana Commission of Higher Education

Post-Secondary Employment Outcomes (PSEO) Data tool

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https://lehd.ces.census.gov/data/pseo_beta_viz.html

Summary of Innovation Measurement Infrastructure

Admin Data on Human Capital Investments (IRIS/IMI, PSEO)

Administrative Data on Patents and Trademarks

Household and Individual Demographic Data (Decennial, ACS, household surveys)

Administrative Longitudinal Data on (near) Universe of Jobs (LEHD)

Administrative Longitudinal Data on (near) of Business and Organizational Units (LBD)

Data on Inputs/Outputs/Productivity from the Economic Census and Annual Surveys

Survey Data on Innovation Investments (e.g., BRDIS)

Admin Data on Innovation Investments (IRIS/IMI)

Survey Data on Management Practices (MOPS)

Where do we go next?

- New data sources linked to reliable universe frames provide opportunities to measure innovation and entrepreneurship

- Challenges include
  - Data access
  - Funding/support
  - Staffing (comp/sci, researchers)
  - Methods (linkage, estimates, privacy protection)

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We Need Help from Researchers and Policy Analysts

- Need help with:
  - Data access
  - Funding/support
  - Staffing (comp/sci, researchers)
  - Methods (linkage, estimates, privacy protection)
  - **Setting Priorities**

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Thank You

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