

The Census Bureau's Business Microdata

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Dallas-Fort Worth Research Data Center
Research Workshop
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June 23, 1993

Robert H. McGuckin
Chief, Center for Economic Studies
Bureau of the Census
U.S. Department of Commerce
Washington, D.C. 20233

Dear Bob:

I thought it would be useful if I sent you some impressions of what was a very interesting visit to the Center for Economic Studies on June 8th.


It was a great pleasure for me to meet the able and enthusiastic staff of the Center for Economic Studies and to learn of the research projects on which they are engaged. It must be a matter of pride for all in the Bureau of the Census to have a unit which, through its research activities, is playing such a valuable role in increasing our understanding of the working of our economic system.

Of course, no individual or institution can do everything. The Center will have to depend on research conducted elsewhere (particularly in universities) for the additional data needed to interpret the results of its research and to develop a more complete and more accurate picture of the structure of the economy. For this reason I greatly welcome the initiative of the Bureau of the Census in establishing an office of the Center in Boston with its powerful academic community and I hope, after assessing your experience in Boston, that it will be found desirable to establish similar offices in other places.

I would not wish to conclude without expressing my gratitude for the many kindnesses I received during my visit from you and the staff of the Center.

With all good wishes,

Yours sincerely,


Ronald H. Coase

RHC:lms

"... And we can also hope to learn much more in future from the studies of the activities of firms which have recently been initiated by the Center for Economic Studies of the Bureau of the Census of the United States. ..." Ronald H. Coase, Nobel Prize Lecture, 1991



UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233
OFFICE OF THE DIRECTOR

YOU'RE INVITED TO A CENSUS BUREAU "FIRST" --

On January 4, 1994, the U.S. Census Bureau -- in conjunction with the National Bureau of Economic Research and with funding from the National Science Foundation -- will open the new **BOSTON RESEARCH DATA CENTER**.


At this new research facility, selected Boston-area researchers will be able to use detailed, non-public Census Bureau microdata on businesses to study economic and policy issues -- without traveling to the Bureau's Washington D.C. headquarters.

The Boston Research Data Center represents a major first step in reaching out to researchers and analysts outside the Washington, D.C. area. It decentralizes access to economic data on the U.S. business sector -- while continuing to protect the confidentiality of the data these businesses provide.

We hope you will join us at the opening ceremony:

Date: Tuesday, January 4, 1994
Time: 1:30 P.M.
Place: U.S. Bureau of the Census
Boston Regional Office
2 Copley Place, Suite 301
(Adjacent to The Westin Hotel, headquarters of the Allied Social Sciences Association Meetings)

For more information on the Boston Research Data Center, please contact the Center for Economic Studies, Bureau of the Census, (301)763-██████.

Sincerely,

Harry A. Scarr
Acting Director
Bureau of the Census

Business Microdata from the Census Bureau

- Business microdata (or “economic” microdata) include data at the:
 - Establishment-level (i.e., individual business location/address)
 - Firm-level (i.e., encompassing all establishments under the same ownership)
 - Transaction-level (exports, imports, domestic shipments)
 - Individual-level (non-employer businesses, business owners, workers)
 - Multiple levels
 - Export & import shipments linked to the U.S. firms involved (LFTTD)
 - Workers (earnings, characteristics) linked to the firms that employ them (LEHD)

Advantages of Census Bureau Restricted-Use Business Microdata

- There is no public-use version of these
 - At best, published data is at the industry-level, at the county-level
 - It is difficult/impossible to produce public-use *business* microdata and maintain confidentiality
- Data for the entire universe of businesses, or for a fully representative scientific sample
- Mandatory reporting (very high response rates)
- Detailed industry (and even sub-industry/product-level detail)
- Detailed geography (sub-county, including address & latitude-longitudinal)
- Data from a business have been linked over time (longitudinal links)
- Data for a business from different Census surveys can be linked together (cross-sectional links)
- Data from non-Census sources (e.g., Compustat, patents, TRI) can be linked in via name-and-address matching

“Popular” Business Microdata

Business Register

- The **Business Register (BR)** is the backbone of nearly all Census Bureau business data (sampling frame)
 - Essentially the universe (7.5 million) of all business establishments in the United States with at least one paid employee
 - Data items are fairly limited:
 - Business name & address
 - EIN
 - Location (county, state)
 - Industry code
 - Employment
 - Payroll
 - Corporate structure (firm ID → sibling establishments; legal form of organization)
 - Identifiers that allow cross-sectional matching across all business surveys & censuses
 - We learn of new firms from the IRS
 - We learn of new establishments within a firm from various Census Bureau surveys

“Popular” Business Microdata

Longitudinal Business Database

- The **Longitudinal Business Database (LBD)** is the “research version” of the Business Register
 - Created by the Center for Economic Studies
 - Essentially the universe (7.5 million) of all business establishments in the U.S. with at least one paid employee
 - Covers most industries (not farms, not government sector)
 - 1976 to present (currently 2015)
 - Similar data items as BR: location (county, state), industry code, employment, payroll, corporate structure (allows aggregation to the firm level)
 - No name & address information
 - Longitudinal identifier (LBDNUM) allows for the identification of establishment entry, exit, continuers (growth), and age
 - Can be linked to all other Census business surveys and censuses

“Popular” Business Microdata

Economic Censuses

- Richer data on establishments and firms come from the myriad of surveys conducted by the Census Bureau, including the **Economic Census**
 - Conducted every 5 years (for years ending in ‘2’ and ‘7’)
 - Covers nearly all sectors of the economy: retail, services, manufacturing, wholesale, construction, financial industries, mining, transportation, utilities
 - No agriculture (except agricultural services)
 - Approximately 7 million employer businesses
 - “All” establishments, except that there are non-mailed cases and non-respondents whose data are fully imputed using BR data
 - About 800 unique survey forms (now, electronic paths)
 - Collects data on value of output, payroll, employment, materials consumed, fuels & electricity consumed, depreciable assets, selected purchased services, inventories, and capital expenditures, output by product line, etc.
 - Also collects data specific to an industry or sector
 - The primary source of information about the structure and functioning of the nation’s economy
 - Important part of the framework for the national income and product accounts, input-output tables, etc.
 - Provides sampling frames and benchmarks for current business surveys, which track short-term economic trends, serve as economic indicators, and enter into GDP estimation

“Popular” Business Microdata

Annual Surveys

- **Annual surveys** collect similar data to the Economic Census, except:
 - Fewer sectors: manufacturing, services, retail, wholesale
 - Only manufacturing is at the establishment-level (the others are at firm-level)
 - Just a sample of the universe
 - Businesses above a certain size are “certainty cases” with weight=1 (at least at the outset)
 - Businesses below that size are “stratified”
 - Establishments are randomly chosen within a strata, with a probability proportionate to its size
 - Weight is constructed accordingly
- There are also quarterly and monthly surveys available

“Popular” Business Microdata

Manufacturing Surveys

- Census of Manufactures (1963, 1967, 1972, 2012)
- Annual Survey of Manufactures (1972-present) – includes constructed TFP
- R&D expenditures (BRDIS/SIRD)
- Capacity utilization (PCU/QPC)
- Energy consumption (MECS)
- Technology use (SMT, CNUS)
- Environmental expenditures (PACE)
- Exports & imports (LFTTD)
- Domestic shipment destinations (CFS)
- Patents
- Capital expenditures & ICT expenditures
- Management & organization practices (MOPS)
- Water use (SWUM)

“Popular” Business Microdata

Longitudinal Firm Trade Transactions Database

- The **Longitudinal Firm Trade Transactions Database (LFTTD)** links individual trade transactions to the firms that undertake them.
 - Export transactions ↔ Exporter (37 million in 2015)
 - Import transactions ↔ Importer (77 million in 2015)
- Transaction information includes:
 - Commodity
 - Value
 - Quantity
 - Weight
 - Date
 - Origin
 - Destination
 - Method of transportation
 - Related-party indicator
- 1992 – 2015

“Popular” Business Microdata

Longitudinal Employer-Household Dynamics (LEHD) Data

- Constructed by the Center for Economic Studies
- Worker files
 - Employee earnings and employment (from state UI records)
 - Individual characteristics (sex, age, education, race, ethnicity)
- Employer files
 - Business characteristics (industry, location, size, age)
 - Workforce characteristics

Business Register Data

Restricted–Use Business Register Microdata			
Data Set	Frequency	Unit of Enumeration	Availability
Compustat–SSEL Bridge (CSB)**	Annually	Firm	1976– 2011
Form 5500 Bridge File	Annually	Establishment	1992– 2012
Integrated Longitudinal Business Database (ILBD)	Various	Establishment	1977, 1982, 1987, 1992, 1994–2014
Longitudinal Business Database (LBD)	Annually	Establishment	1976–2015
Ownership Change Database (OCD)	Every 5 Years (Discontinued)	Establishment	1963, 1967–2002
Report of Organization Survey <i>Also known as Company Organization Survey (COS)</i>	Annually	Firm	2002–2013
Standard Statistical Establishment List / Business Register (SSEL)	Annually	Establishment	1974–2015

**The CSB is only available with a current Compustat license.

Economic Census Data

Restricted–Use Economic Census Microdata

Data Set	Frequency	Unit of Enumeration	Availability
Census of Auxiliary Establishments (AUX)	Every 5 Years	Establishment	1977–2012
Census of Construction Industries (CCN)	Every 5 Years	Establishment	1972–2012
Census of Finance, Insurance, and Real Estate (CFI)	Every 5 Years	Establishment	1992–2012
Census of Island Areas – Puerto Rico (CIAPR)	Every 5 Years	Establishment	1992–2007
Census of Manufactures (CMF)	Every 5 Years	Establishment	1963, 1967–2012
Census of Mining (CMI)	Every 5 Years	Establishment	1987–2012
Census of Retail Trade (CRT)	Every 5 Years	Establishment	1977–2012
Census of Services (CSR)	Every 5 Years	Establishment	1977–2012
Census of Transportation, Communications, and Utilities (CUT)	Every 5 Years	Establishment	1987–2012
Census of Wholesale Trade (CWH)	Every 5 Years	Establishment	1977–2012

Other Establishment Surveys

Data Set	Frequency	Unit of Enumeration	Availability
Annual Survey of Manufactures (ASM)	Annually	Establishment	1973–2016
Current Industrial Reports (CIR)	Annually (Discontinued)	Establishment	1993–2011
Manufacturing Energy Consumption Survey (MECS)	Various	Establishment	1985, 1988, 1991, 1994, 1998, 2002, 2006, 2010
Medical Expenditure Panel Survey – Insurance Component (MEPS–IC)	Annually	Establishment	1996–2006, 2008–2016
National Employer Survey (NES)	Various	Establishment	1994, 1996, 1997, 1998
Quarterly Survey of Plant Capacity Utilization (QPC)/Survey of Plant Capacity Utilization (PCU)	Quarterly	Establishment	1974–2017
Survey of Manufacturing Technology (SMT)	Various (Discontinued)	Establishment	1988, 1991, 1993
Survey of Pollution Abatement Costs and Expenditures (PACE)	Various (Discontinued)	Establishment	1974–1982, 1984–1986, 1988–1994, 1999, 2005

Firm Surveys

Data Set	Frequency	Unit of Enumeration	Availability
Annual Capital Expenditures Survey (ACES) <i>Includes Information and Communication Technology (ICT) Supplement starting in 2003</i>	Annually	Firm	1993–2016
Annual Retail Trade Survey (ARTS)	Annually	Firm	1999–2015
Annual Survey of Entrepreneurs (ASE)	Annually	Firm	2014
Annual Wholesale Trade Survey (AWTS)	Annually	Firm	1995–2015
Business Expenditures Survey (BES) <i>Also known as Business Expenses Supplement</i>	Every 5 Years (Discontinued)	Firm	1992–2007
Business Research & Development and Innovation Survey (BRDIS) <i>See also SIRD</i>	Annually	Firm	2008–2015
Enterprise Summary Report (ESR)	Every 5 Years	Firm	1977–1992
Exporter Database (EDB)	Annually	Firm	1992, 1996–2010
Kauffman Firm Survey (KFS) <i>Must be used in conjunction with Census Bureau restricted-use microdata</i>	Annual	Firm	2004–2010
Manufacturers' Shipments, Inventories, and Orders (M3)	Monthly	Firm	1992–2017
Manufacturers' Unfilled Orders Survey (M3UFO)	Annual	Firm	2009–2013
Monthly Retail Trade Survey (MRTS)	Monthly	Firm	1997–2015
Monthly Wholesale Trade Survey (MWTS)	Monthly	Firm	2006–2016
Quarterly Financial Report (QFR)	Annually	Firm	1977–2014
Quarterly Services Survey (QSS)	Quarterly	Firm	2003–2014

Summary of Recovered Historical Economic Microdata

August 2012

This summary highlights some of the business microdata recovered from the Unisys Clearpath mainframe.¹ Note it is very difficult to summarize this information succinctly, for a variety of reasons, not the least of which is that there are thousands of files, many with only a crude description (if any at all) in the associated paper file. Also note, presence on the list below does not necessarily guarantee there are usable microdata files. And, in some cases, the lack of a record layout may make recovered data very difficult to use – unless related data and/or record layouts exist. Further details are available upon request. Meanwhile, for the list of surveys and years that CES *currently* has and makes available, see <http://www.census.gov/ces/dataproducts/>.

For more information on the recovered data, email CES.Data.Recovery.List@census.gov or see <http://www.census.gov/ces/dataproducts/recovered/>.

Manufacturing and Mining

Census of Manufactures	
Special inquiries data	1967, 1972, 1977, 1982
Class of customer data	1967, 1977
CAO (auxiliary establishments)	1977
MA-131 (Supplemental Survey of Materials Consumed)	1972
Location of plants	1963
Ancillary data (e.g., flags, name and address, edit parameters)	1967, 1972, 1977, 1982
Census of Manufactures (Puerto Rico)	1967, 1972, 1977, 1992
Census of Mining	1963, 1967, 1972, 1977, 1982
Annual Survey of Manufactures	
Main files	1953-1964, 1966-1971
ITS (longitudinally-linked ASM estabs)	1954-1961
CAO (auxiliary establishments)	1974, 1977-81, 1983-86, 1988-91
Fixed Base Difference files	1974, 1978-85, 1989, 1991
MA-175 (Defense, Government)	1981-84
Defense Mobilization	1987, 1989
Ancillary data (flags, parameters, sampling universes, etc.)	Various years
Name and address files	Various years
Fuel and Electric Energy supplement	1974, 1976
MA-452 (Survey of the Consumption of Selected Hydrocarbon, Coal, and Coke Materials)	1978-80
Survey of Water Use in Manufacturing	1973, 1978, 1983
Capital Asset and Depreciation Survey	
Survey of Industrial R&D	1967-70
Survey of Plant Capacity	1973-88 (additional data and flags)
Pollution Abatement Costs and Expend. Survey	1980, 1983/84
Zvi Griliches project files (includes R&D, CM)	1957-1980
Lawrence Klein project data	
Ruggles project files	1954-59, 1972-81
Annual Survey of Oil and Gas	1974-82
Business (i.e., non-manufacturing)	
Census of Business	1972
Census of Retail (various)	1963, 1967(Puerto Rico), 1972(Capital Expenditure)
Census of Wholesale	1958, 1963, 1967
Census of Services	1963, 1967, 1967(Lawyers), 1967(Capt Exp Med Assets)

¹ A small portion of the listed microdata were recovered from other sources.

Service and Retail Capital Expenditure Survey	1972
Annual Retail Trade Survey	1974, 1979-81, 1984-86, 1990-97
Annual Wholesale Trade Survey ²	1980, 1982-87, 1989-97
Services Annual Survey	1987, 1990-97
Heating Fuel Survey	1979-80
Survey of Gallonage Sales of Gasoline	1980-82
Canned Food Survey	1981

International Trade

Imports (transactions)	1989-90
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Business Register

SSEL files (various)	1974-87, 1989
County Business Patterns establishment files	1976-84
Other administrative records files	1977-82
Enterprise Statistics	1972, 1977

Non-employers

Survey of Minority-owned Business Enterprises	1972, 1977, 1982, 1987
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Outlying Areas

Economic Census	1982
Puerto Rico	
Census of Retail	1967
Census of Manufactures	1967, 1972, 1977
Census of Construction	1977

Transportation

Commodity Transport Survey (now Commodity Flow Survey)	1967, 1972, 1977
Domestic and International Transportation of U.S. Foreign Trade	1976
DOT Final GAT-1 and PUT-1	
Truck Inventory and Use Survey (public use?)	1977
Warehousing and Trucking Survey	1990-97

Construction

Building Permits	1970-86, 1989
Survey of Housing Starts, Sales, and Completions (HSS)	1979-83
Progress Reporting	1973-83

Agriculture

Census of Agriculture	1964, 1969, 1974, 1978 (+ "Farm Real Estate Survey" and "Hired Labor")
Census of Agriculture - Puerto Rico	1969, 1978, 1982
Census of Agriculture - Guam, Virgin Islands	1982
Census of Agricultural Services	1969, 1978
Farm Finance Survey	1969 (or 1974?), 1978, 1979(Landlords; Operators)
Census of Commercial Fisheries	1967
Census of Irrigation	1969
Census of Horticulture	1979, 1988

² This survey is at times also called the "Annual Trade Survey".

Transaction Data

Data Set	Frequency	Unit of Enumeration	Availability
Commodity Flow Survey (CFS)	Various	Establishment	1993, 1997, 2002, 2007, 2012
Foreign Trade Data – Exports (EXP)	Monthly	Transaction	1992–2016
Foreign Trade Data – Imports (IMP)	Monthly	Transaction	1992–2016
Longitudinal Firm Trade Transactions Database (LFTTD)	Monthly	Transaction	1992–2015

Longitudinal Employer-Household Dynamics (LEHD) Data

LEHD Restricted-Use Microdata

Data Set	Unit of Observation	Years
Business Register Bridge (BRB)	Establishment	1990–2008
Employer Characteristics Files (ECF)	Establishment – Quarter	1989–2011
Employment History Files (EHF)	Job (Person–Firm)	1985–2011
Geocoded Address List (GAL)	Establishment	1990–2011
Individual Characteristics Files (ICF)	Person	1985–2011
Quarterly Workforce Indicators (QWI)*	Establishment – Quarter	1990–2011
Unit-to-Worker (U2W)	Job (Person–Establishment)	1990–2011

The Productivity of RDC Researchers Using Census Bureau Microdata

- In 2017, RDC researchers using Census Bureau microdata published:
 - At least 91 working papers (CES, NBER, university mimeos, etc.)
 - At least 81 journal articles (including those known to be forthcoming)
 - 11 in the Top 5 journals in economics (AAA)
 - 11 in AA journals in economics (ranked 6-20)
 - 22 in A journals in economics (ranked 21-102)
 - 16 of the top 22 journals in economics published RDC research in 2017 (or forthcoming)
- From 2010-2017 (and forthcoming)
 - 10 articles in *American Economic Review* (does not include P&P)
 - 9 articles in *Quarterly Journal of Economics*
 - 8 articles in *Journal of Political Economy*
 - 3 articles in *Review of Economic Studies*
 - 2 articles in *Econometrica*
- For examples, see:
 - Appendix 2 of each CES & RDC Annual Report: www.census.gov/ces/publications/publications.html
 - *Center for Economic Studies Working Paper Series*: ideas.repec.org/s/cen/wpaper.html

Research Tips

For Proposal Development & Beyond

- Find all relevant Census Bureau publications (or webpages) containing:
 - Sample details (size, coverage, etc.)
 - Survey methodology (editing, imputation, weighting, etc.)
 - Survey instrument & instructions (variable definitions)
 - Published tables
- Often PDF scans are available online (Census Bureau, archive.org, Google Books)
- RDC administrator (and RDC researchers) have access to survey forms archive
- Feel free to contact me for help in finding publication or survey form
- Recent dissemination has been all electronic (web pages, American FactFinder)
- Seek out working papers, publications, and researchers that have used the same data

Research Tips

For Early Stages of Research

- Try to replicate published statistics
 - Key variables: Number of firms, number of establishments, employees, etc.
 - Tabulate by industry, by geography, etc.
 - Look for “tabulation flag”
 - Use weights (if applicable)
- Getting to within $\pm 5\%$ is a good way of knowing that you’ve got the right data, the right set of cases, and so forth
- Beware of imputation!
 - Survey data are generally considered the most reliable data, followed by administrative data, followed by imputed data
 - Look for impute or “source” flags
 - Most likely for smaller businesses
 - Imputes are designed to make reliable aggregates -- not necessarily reliable microdata

Graduate Students & Dissertations

- At the end of 2017, there were about 130 graduate students using the RDCs for their Ph.D. dissertation work
 - 48 different universities
 - 108 using Census Bureau microdata (vs. NCHS, AHRQ)
 - This does not include the many graduate students who use the RDCs as research assistants to others
- CES Dissertation Mentorship Program
 - 44 participants since 2008 from 25 different universities:
 - Columbia University, Cornell University, Duke University, Florida State University, George Washington University, Georgia State University, Georgia Tech, Harvard University, Massachusetts Institute of Technology, Michigan State University, Stanford University, Syracuse University, Texas A&M University, University of Houston, University of Illinois at Chicago, University of Iowa, University of Maryland, University of Michigan, University of Minnesota, University of Missouri, University of North Carolina, University of Pennsylvania, University of Texas, University of Virginia, University of Wisconsin

CES Dissertation Mentorship Program

- CES wants to assist doctoral candidates who are actively engaged in dissertation research in economics, sociology, demography, or a related field using Census Bureau microdata at a Research Data Center.
- Program participants receive two principal benefits:
 - One or more CES staff economists are assigned as mentors and advise the participant on the use of Census Bureau microdata.
 - A visit to CES where they meet with staff economists and present research in progress. Trip expenses (airfare, hotel, and meals) will be paid for by CES.
- Eligible candidates must be
 - Actively working on a Ph.D. thesis in economics or a related field using Census Bureau microdata at a Research Data Center.
 - A U.S. citizen
- To apply:
 - Submit the following via email to CES.Mentorship.List@census.gov
 - Contact information, name(s) of faculty advisor, and expected completion date, or a CV with that information.
 - Title and abstract of RDC–based dissertation research, including a description of microdata being used.
- Acceptance will be on a rolling basis, as funding and staffing resources allow.

My “Academic” Research

- The effects of environmental regulation on the behavior of manufacturing firms, including:
 - Plant location, investment, and survival (CM)
 - Becker, Randy A. The Effects of Environmental Regulation on Firm Behavior. *Ph.D. dissertation*, Department of Economics, Brown University, 1998.
 - Becker, Randy, and Vernon Henderson, “Effects of Air Quality Regulations on Polluting Industries,” *Journal of Political Economy*, 108(2), 379-421, April 2000.
 - Production costs (CM, ASM, and PACE survey)
 - Becker, Randy A. and J. Vernon Henderson, “Costs of Air Quality Regulation,” in *Behavioral and Distributional Effects of Environmental Policy*, Carlo Carraro and Gilbert E. Metcalf (eds.), National Bureau of Economic Research and The University of Chicago Press, 2001.
 - Environmental spending (ASM, PACE survey)
 - Becker, Randy A. “Air Pollution Abatement Costs under the Clean Air Act: Evidence from the PACE Survey,” *Journal of Environmental Economics and Management*, 50(1), 144-169, July 2005.

My Research (cont.)

- Environmental spending by business size (PACE, ASM, CM)
 - Becker, Randy A., Carl Pasurka Jr., and Ronald J. Shadbegian, “Do Environmental Regulations Disproportionately Affect Small Businesses? Evidence from the Pollution Abatement Costs and Expenditures Survey,” *Journal of Environmental Economics and Management*, 66(3), 523-538, November 2013.
- Environmental spending & pollution havens (PACE, ASM)
 - Becker, Randy A. “Pollution Abatement Expenditure by U.S. Manufacturing Plants: Do Community Characteristics Matter?” *Contributions to Economic Analysis & Policy*, 3(2), Article 6, December 2004.
- Spatial heterogeneity in environmental regulation (PACE)
 - Becker, Randy A. “On Spatial Heterogeneity in Environmental Compliance Costs,” *Land Economics*, 87(1), 28-44, February 2011.
- Productivity (CM, ASM)
 - Becker, Randy A. “Local Environmental Regulation and Plant-level Productivity,” *Ecological Economics*, 70(12), 2516-2522, October 2011.
- Employment (ASM, CM)
 - Becker, Randy A., Ann Ferris, and Ron Shadbegian. “Air Quality Regulations, Electricity Prices, and Labor Demand.” *In progress*.

My Research (cont.)

- International trade (Imports, Exports)
 - Becker, Randy A. and John P. Tang. “U.S. Trade in Toxics: The Case of Chlorodifluoromethane (HCFC-22),” *Center for Economic Studies Discussion Paper*, 09-29, September 2009.
- The “green industry” (CM, 1995 Survey of Environmental Products & Services)
 - Becker, Randy A. and Ronald J. Shadbegian, “Environmental Products Manufacturing: A Look Inside the Green Industry,” *The B.E. Journal of Economic Analysis & Policy*, 9(1), Topics, Article 7, March 2009.
- Industrial water use (ASM, Survey of Water Use in Manufacturing)
 - Becker, Randy A. “Water Use and Conservation in Manufacturing: Evidence from U.S. Microdata,” *Water Resources Management*, 30(12), 4185-4200, September 2016.

Some By-Products of This Research

- Involvement in the redevelopment of Pollution Abatement Costs and Expenditures (PACE) Survey, with EPA
 - Becker, Randy A. and Ronald J. Shadbegian, “A Change of PACE: Comparing the 1994 and 1999 Pollution Abatement Costs and Expenditures Surveys,” *Journal of Economic and Social Measurement*, 30(1), 63-95, December 2005.
 - Becker, Randy A. and Ronald J. Shadbegian, “Issues and Challenges in Measuring Environmental Expenditures by U.S. Manufacturing: The Redevelopment of the PACE Survey,” in *Proceedings of the Third International Conference on Establishment Surveys (ICES-III)*, pp. 1361-1372, Alexandria, VA: American Statistical Association, 2007.
 - Becker, Randy A. “Measuring Pollution Abatement Expenditures: The U.S. Experience” (translated into Spanish), in *La Estadística Ambiental en México [Environmental Statistics in Mexico]*, Alfonso Mercado García and Carlos Roberto López Pérez (eds.), El Colegio de México, 2014.
- Advisory roles on the “green industry” with the Brookings Institute, Department of Commerce, and Bureau of Labor Statistics
- Water use in manufacturing & mining added to the 2017 Economic Census

Contact Information

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