The U.S. Cluster Mapping Project: A New Tool For Regional Economic Development

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U.S. Cluster Mapping Launch Event
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E·D·A
U.S. ECONOMIC DEVELOPMENT ADMINISTRATION

Outline

- Clusters Are Everywhere
- Clusters Matter
- Cluster Mapping as a Tool for Economic Development
- Clusters Going Forward

Clusters Are Everywhere

A cluster is a **regional concentration of related industries** connected through various types of linkages and spillovers and supporting institutions

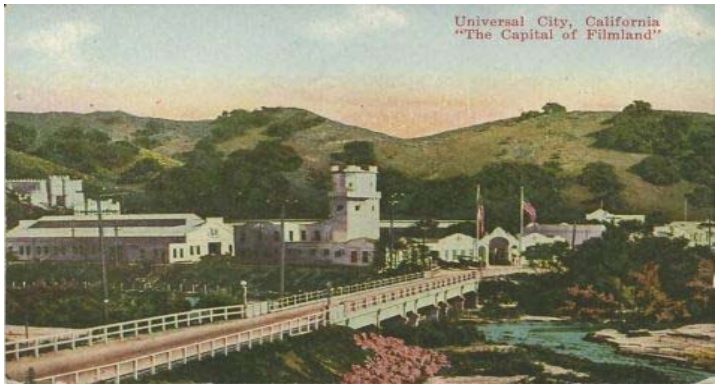
Wine cluster in South Australia

Automotive cluster in Ontario

Medtronic

3M Boston Scientific

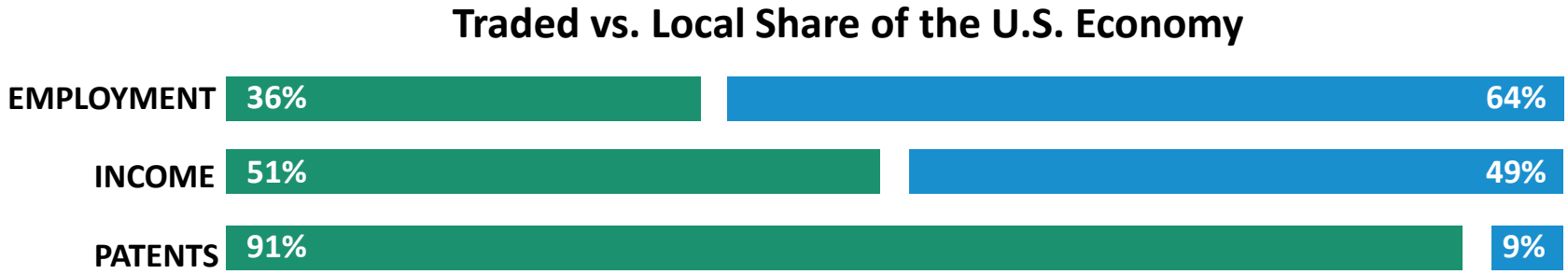
Medical Devices in Minneapolis



Motion Picture cluster in LA
(Universal Studios, 1915)

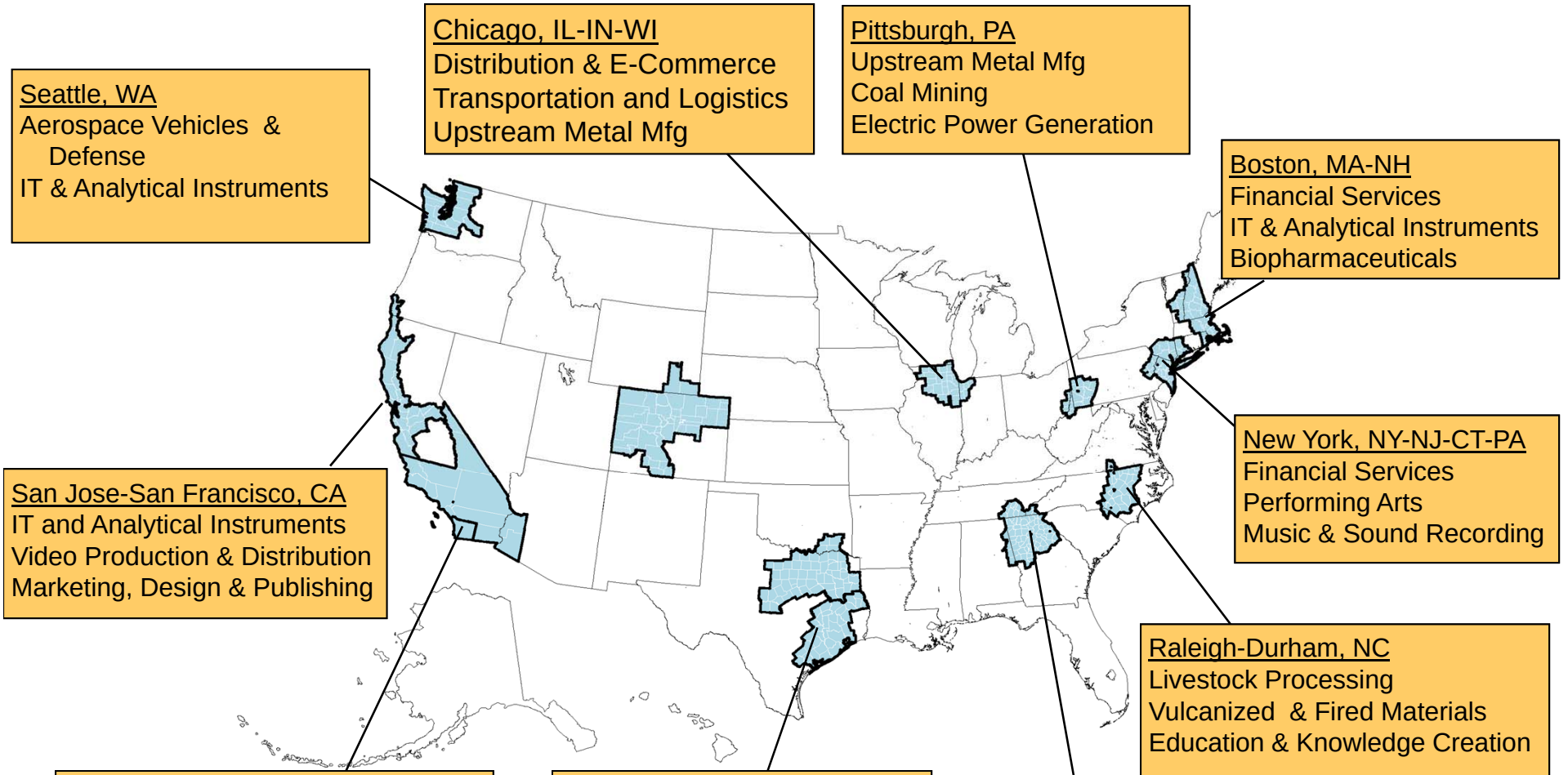
How Important are Clusters?

- More than **50% of U.S. private payroll are generated in economic sectors that 'cluster'**



- In the traded economy, productivity, wage, and patenting are **significantly higher** than in the average of the economy
- Roughly **44% of traded employment is in strong clusters** (i.e. regional clusters with significant critical mass)
- Regions **at all stages of development** benefit from cluster presence
- There is **significant variation** in terms of cluster presence and cluster portfolio composition across U.S. regions

Clusters Across US Regions



Seattle, WA
Aerospace Vehicles & Defense
IT & Analytical Instruments

Chicago, IL-IN-WI
Distribution & E-Commerce
Transportation and Logistics
Upstream Metal Mfg

Pittsburgh, PA
Upstream Metal Mfg
Coal Mining
Electric Power Generation

Boston, MA-NH
Financial Services
IT & Analytical Instruments
Biopharmaceuticals

New York, NY-NJ-CT-PA
Financial Services
Performing Arts
Music & Sound Recording

San Jose-San Francisco, CA
IT and Analytical Instruments
Video Production & Distribution
Marketing, Design & Publishing

Raleigh-Durham, NC
Livestock Processing
Vulcanized & Fired Materials
Education & Knowledge Creation

San Diego, CA
Recreational & Small Electric Goods
Biopharmaceuticals
Water Transportation

Houston, TX
Oil and Gas Production
Construction Products & Svc
Environmental Services

Atlanta, GA
Textile Mfg
Apparel
Communications Equipment

Source: Prof. Michael E. Porter, Cluster Mapping Project, Institute for Strategy and Competitiveness, Harvard Business School; Richard Bryden, Project Director.

Do Clusters Matter?

Do Regions Specialized in Clusters Grow Faster?

- **Data challenge**
  - **Clusters are everywhere, but how do we measure them?**
  - We need benchmark cluster definitions that allow us to compare clusters across all regions

- **Methodological challenge**
  - **Cluster theory** suggests agglomeration arises ***across related economic units*** (Porter 1990, 1998)
  - We need a method that allows us to capture agglomeration that arises among related industries
  - Important prior work (e.g., Glaeser et al. 1992, 2010) focused on testing the impact of specific agglomeration channels such as localization or urbanization economies

Addressing the Data Challenge

The US Cluster Mapping Project V 1.0 (Porter, 2003)

- Industries in the County Business Patterns data are grouped empirically into **3 types:**
  - Local
  - Natural Resource Dependent
  - Traded
- **Traded industries** are grouped into **41 Traded Clusters**
  - Based on co-location patterns of industry employment across regions to capture revealed linkages of various types
  - Final cluster groupings informed by expert judgment
  - Clusters often contain **manufacturing and service industries** and industries from **different parts of the SIC system**

Do Clusters Matter?

- **Cluster theory** suggests agglomeration arises *across related economic units* (Porter, 1990, 1998, 2003)

- **Our Approach: If clusters matter, then the growth of an industry in a region will be increasing in the strength of the regional cluster within which that industry operates**

- Cluster-driven agglomeration could arise in different channels:
  - Across related industries **Within a Cluster**
  - Across **Related Clusters**
  - Across the **Same Cluster in Neighboring Regions**

Clusters and Jobs

- **Industries within stronger clusters are associated with higher levels of job growth from the early 1990s to the mid-2000s**

		INDUSTRY SPECIALIZATION	
		Low	**High**
CLUSTER SPECIALIZATION Strength of Regional Clusters (presence of related industries)	**Low**	+13%	0%
	High	**+20%**	**+1%**

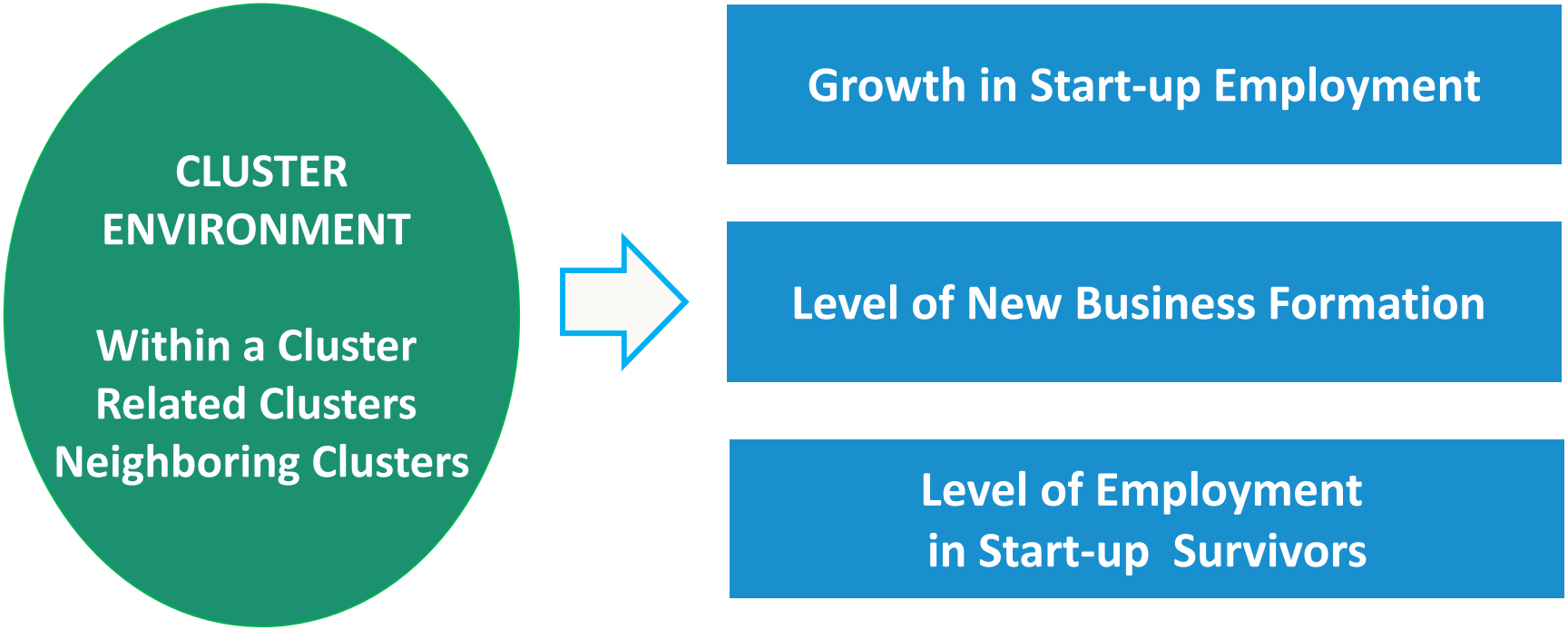
Note: **Average Region-Industry Annualized Employment Growth over 1990-2005**. Region (EA) and Industry (4-digit SIC). N=55083. Cluster specialization variable is measured by Location Quotient. High means above the median of the variables.

- We test the role of clusters by estimating region-industry employment growth over 1990-2005 as a function of the initial *Industry Specialization* and *Cluster Specialization* (outside the industry) in a region, and a set of region and industry fixed effects

Clusters and Entrepreneurship

Industries that are part of a strong cluster environment register

- higher growth of start-up activity
- higher level of start-up activity
- higher level of employment in surviving start-up firms



Source: Delgado/Porter/Stern, Clusters and Entrepreneurship, Journal of Economic Geography, 2010

Clusters Matter for Innovation, Wages, and New Industries

We also estimate the effect of clusters on other dimensions of regional industry and regional performance:

- **Clusters contribute to the growth of *existing* industries**
  - Industries participating in a strong cluster register higher growth of wages and innovation (as well as higher employment growth)
  - There are complementarities between the innovation and employment performance in clusters
- **Clusters contribute to the creation of *new* industries**
  - New industries are more likely to emerge if the can integrate into an existing cluster, or if related or neighboring clusters are strong
- **Strong clusters contribute to the overall growth of the region**
  - Strong traded clusters in a region contribute to the employment growth of other traded and local activities in that region

Source: Delgado/Porter/Stern, 2012, 2014

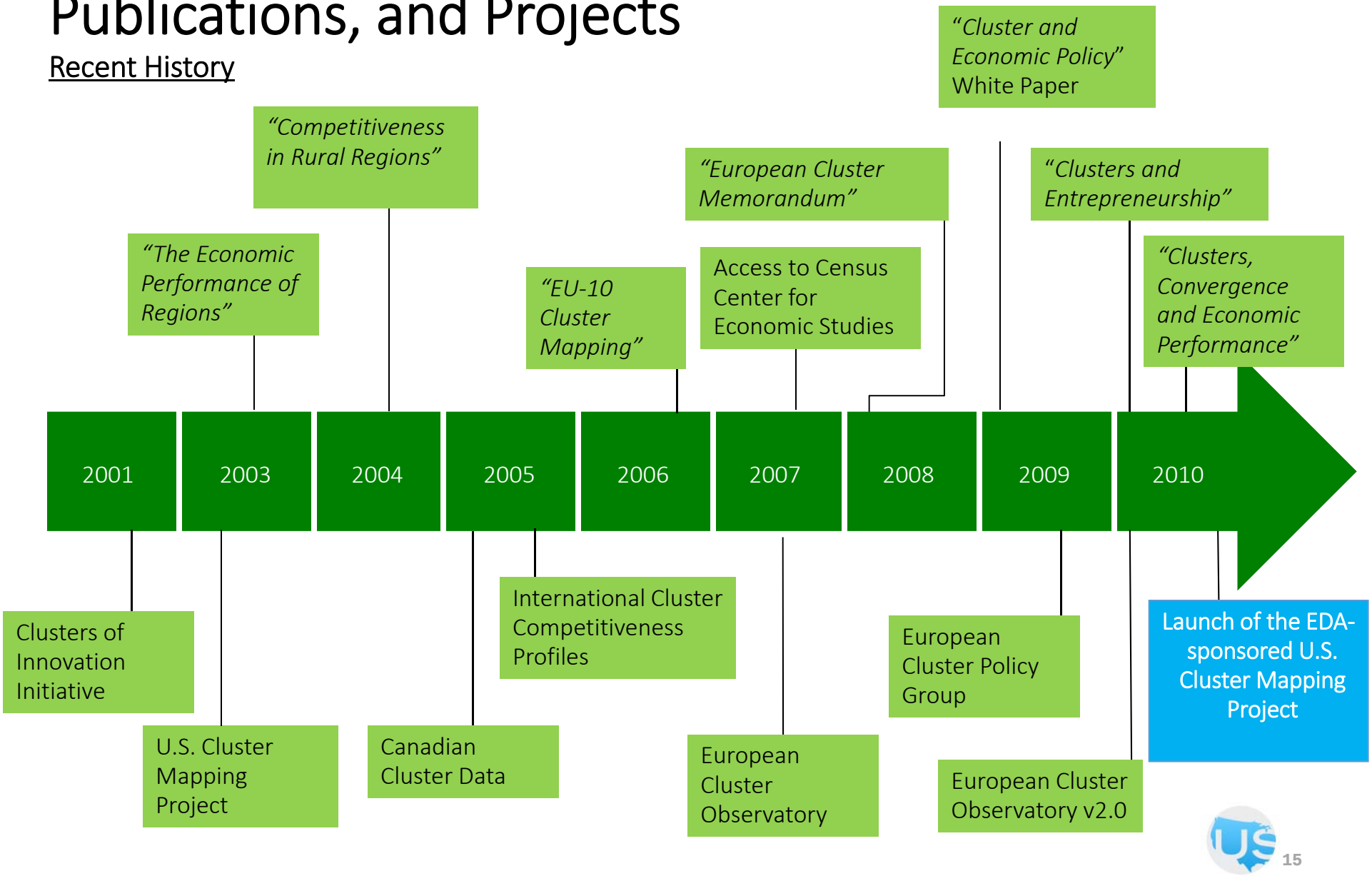
Clusters Matter

- Positive effects of clusters on **various facets of** regional industry and regional **performance**
- **No measured trade-offs** across multiple performance dimensions
- Clusters **matter at multiples levels of geography**
- Clusters **faciliate related economic diversification in regions**

Cluster Mapping as a Tool for Economic Development

Building on a Decade of Cluster Research, Publications, and Projects

Recent History

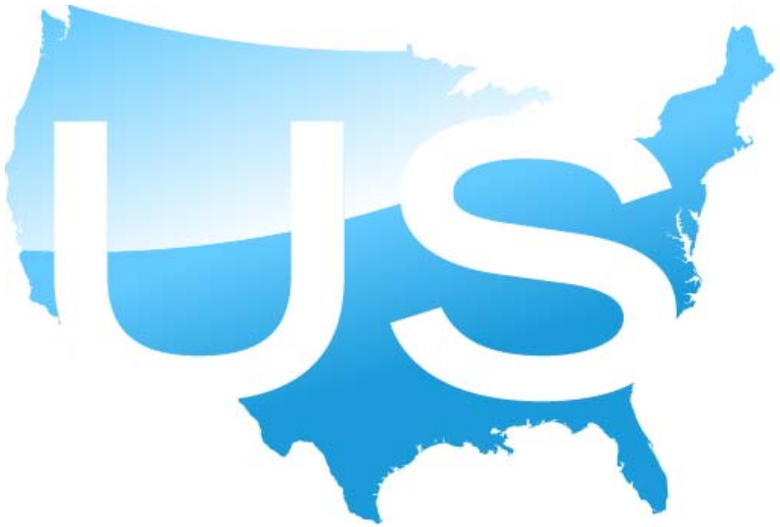


The Need for a National Cluster Tool

- The cluster composition of regions differs greatly
- Empirical evidence that clusters matter (E.g., Porter 2003, Feldman and Audretsch 1999, Feser et al. 2008, Glaeser and Kerr 2009, Delgado, Porter, and Stern 2010, 2014)
- A case for **Cluster-Based Economic Development** to be grounded in empirical evidence and practitioners experience
- A focus on the unique cluster composition in regions to
  - Reinforce established and emerging clusters and their related clusters
  - Exploit the cluster strength in neighboring regions
- The U.S. **has lacked a national cluster portal** to provide the necessary data, analytical tools, and contacts, even though important cluster-based programs have been launched around the country

The EDA Opportunity

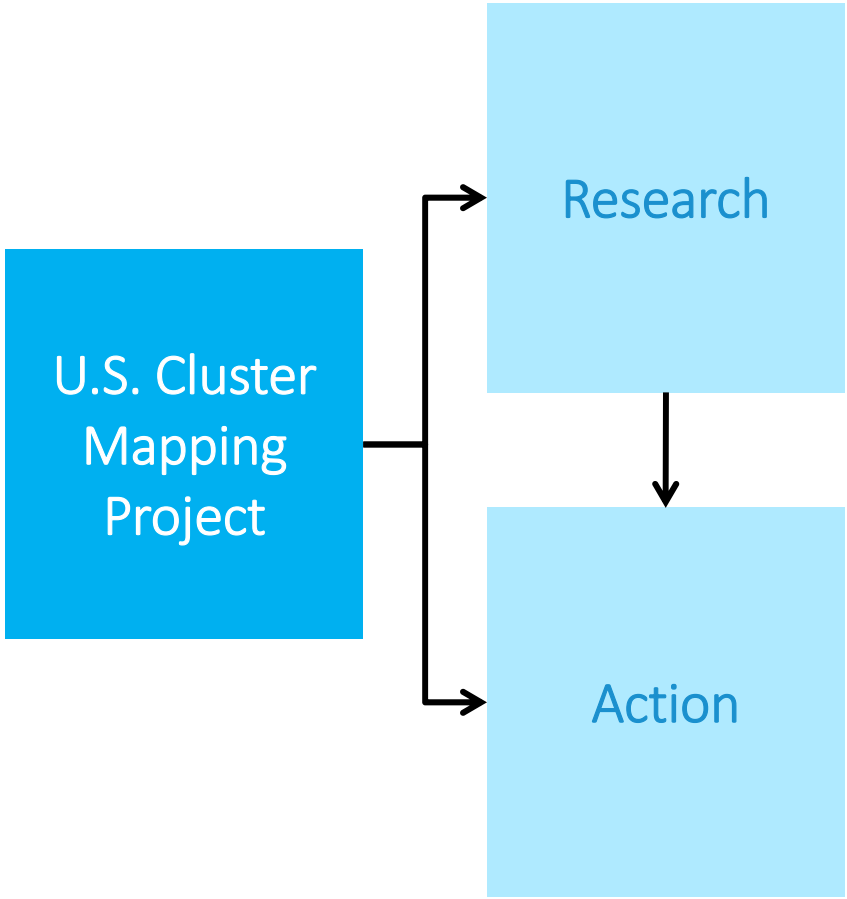
The U.S Economic Development Administration sponsored the US Cluster Mapping Project



CLUSTER MAPPING

- National economic initiative based at Harvard Business School and sponsored by the U.S. Department of Commerce's Economic Development Administration.

U.S. Economic Development Administration Sponsored U.S. Cluster Mapping Project



- Better cluster data
- New regional data
- New cluster initiative data

- *Next phase of comprehensive, action-oriented analysis*

- New interface
- New tools

- *Step change in scope and quality of public and private efforts*

Core Project Partners

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USCMP
Better Cluster Data: Principles

- Use the latest industry definitions and data
- Define a **transparent** and **robust** set of cluster definitions that can "raise the bar" for cluster analysis and regional policymaking going forward
- Develop a **systematic methodology for cluster definitions** (building on prior work) that allows definitions to be easily revised overtime
- Ensure that cluster definitions (and underlying methodology) are **publicly available** through an interactive and accessible website

Defining Clusters of Related Industries
Novel Clustering Methodology

- We develop a clustering algorithm that **systematically generates and assesses** alternative sets of cluster definitions – i.e. groups of industries closely related by skill, technology, supply, demand, and/or other linkages
- Our method generates **comparable** sets of cluster definitions (i.e., the industries that constitute a cluster are the same for all regions)
- The method is novel by providing **scores that assess the quality of each set** of clusters (i.e., its ability to capture meaningful inter-industry linkages within clusters).
- We implement this clustering algorithm to **create a new set of U.S. Benchmark Cluster Definitions** (BCD)
- Methodological paper: "Defining clusters of related industries" (Delgado, Porter and Stern 2014) revisits and extends "The Economic Performance of Regions" (Porter 2003)

The Clustering Algorithm

- Categorize industries as traded vs. local (778 traded 6-digit NAICS)
- Group traded industries into clusters accounting for multiple measures of inter-industry relatedness:

Region-Industry measures	National Industry measures
Co-location of Industry Employment (US Census CBP)	Input-Output Links (BEA National Input-Output Tables)
Co-location of Industry Establishments (US Census CBP)	Occupational Correlation (BLS Occupational Employment Statistics)

- Derive candidate cluster configurations, *C*, using advanced methods from cluster analysis (Everitt et al., 2011)

C=Function (Inter-Industry Relatedness Measures, Parameter Choices)

- Optimize a score function to choose a C^* that captures the broadest range of inter-industry linkages. The methodology concludes with an expert assessment and adjustment of individual clusters
- This results in the **U.S. Benchmark Cluster Definitions (BCD) which groups 778 traded industries into 51 clusters**

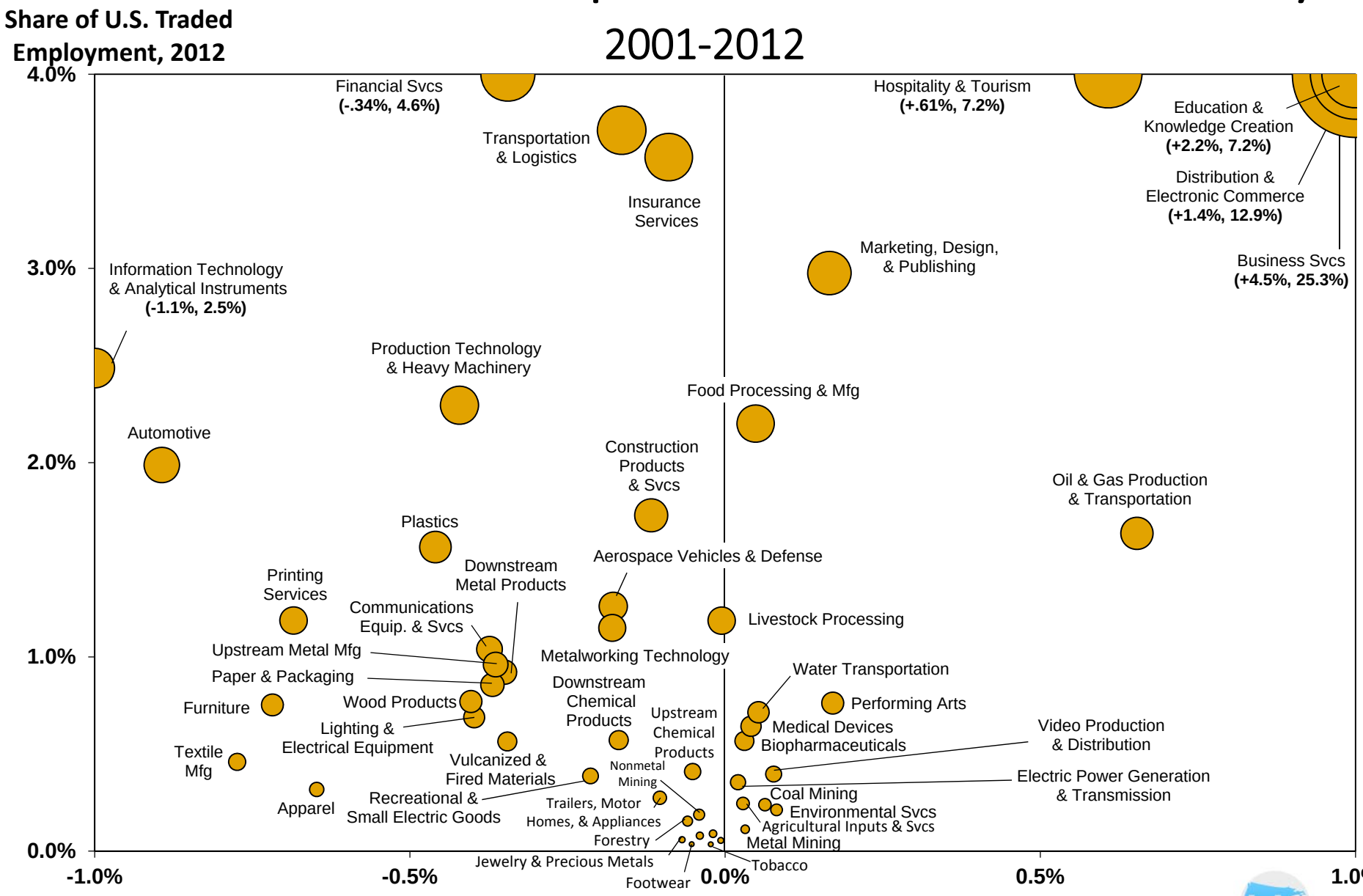
USCMP
Aerospace Vehicles and Defense Cluster

Description: Establishments in this cluster manufacture aircraft, space vehicles, guided missiles, and related parts. This cluster also contains firms that manufacture the necessary search and navigation equipment used by these products.

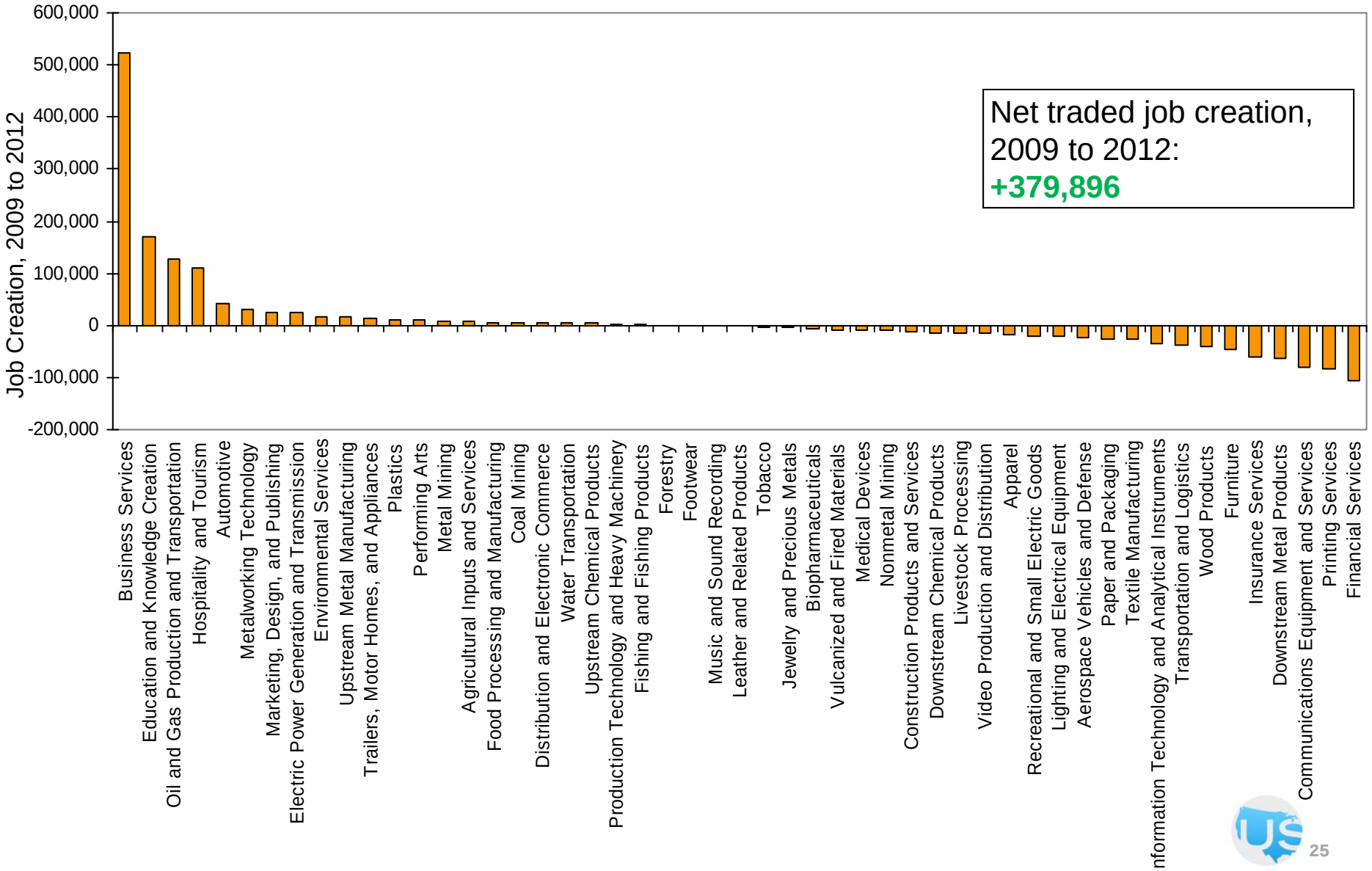
NAICS 7 Industries	**NAICS Name**	**Subcluster Name**	**Within Cluster Relatedness (WCR_{ic})**	
			Rank (1 = best)	**Score**
336411	Aircraft Manufacturing	Aircraft	1	3.531
336412	Aircraft Engine and Engine Parts Manufacturing	Aircraft	1	1.653
336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing	Aircraft	1	2.215
336414	Guided Missile and Space Vehicle Manufacturing	Missiles & Space Vehicles	1	1.467
336415	Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing	Missiles & Space Vehicles	1	1.885
336419	Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing	Missiles & Space Vehicles	1	0.986
334511	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	Search & Navigation Equipment	1	1.773

Source: Delgado/Porter/Stern, 2014, "Defining Clusters of Related Industries," NBER WP 20375

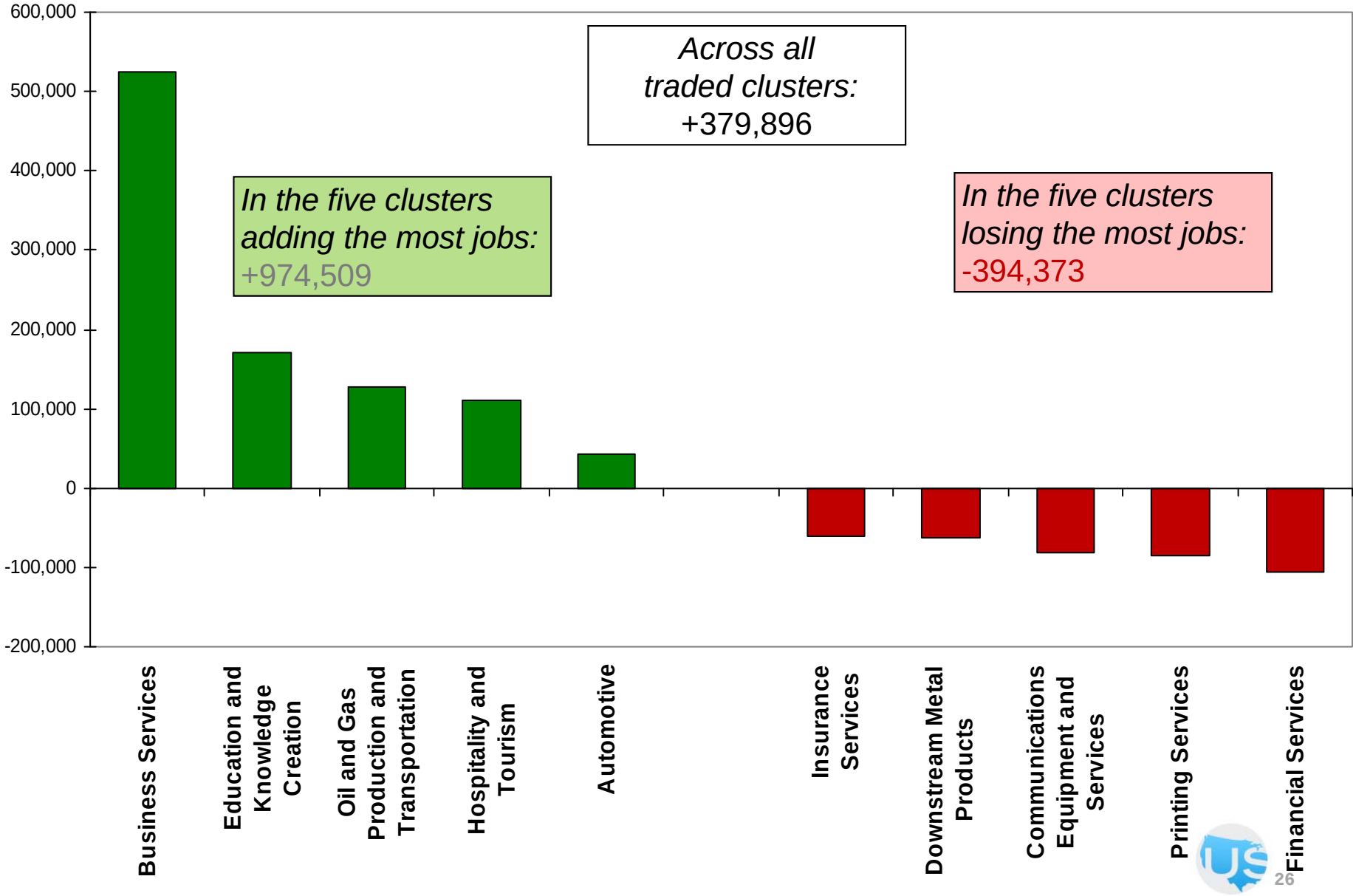
Traded Cluster Composition of the U.S. Economy 2001-2012



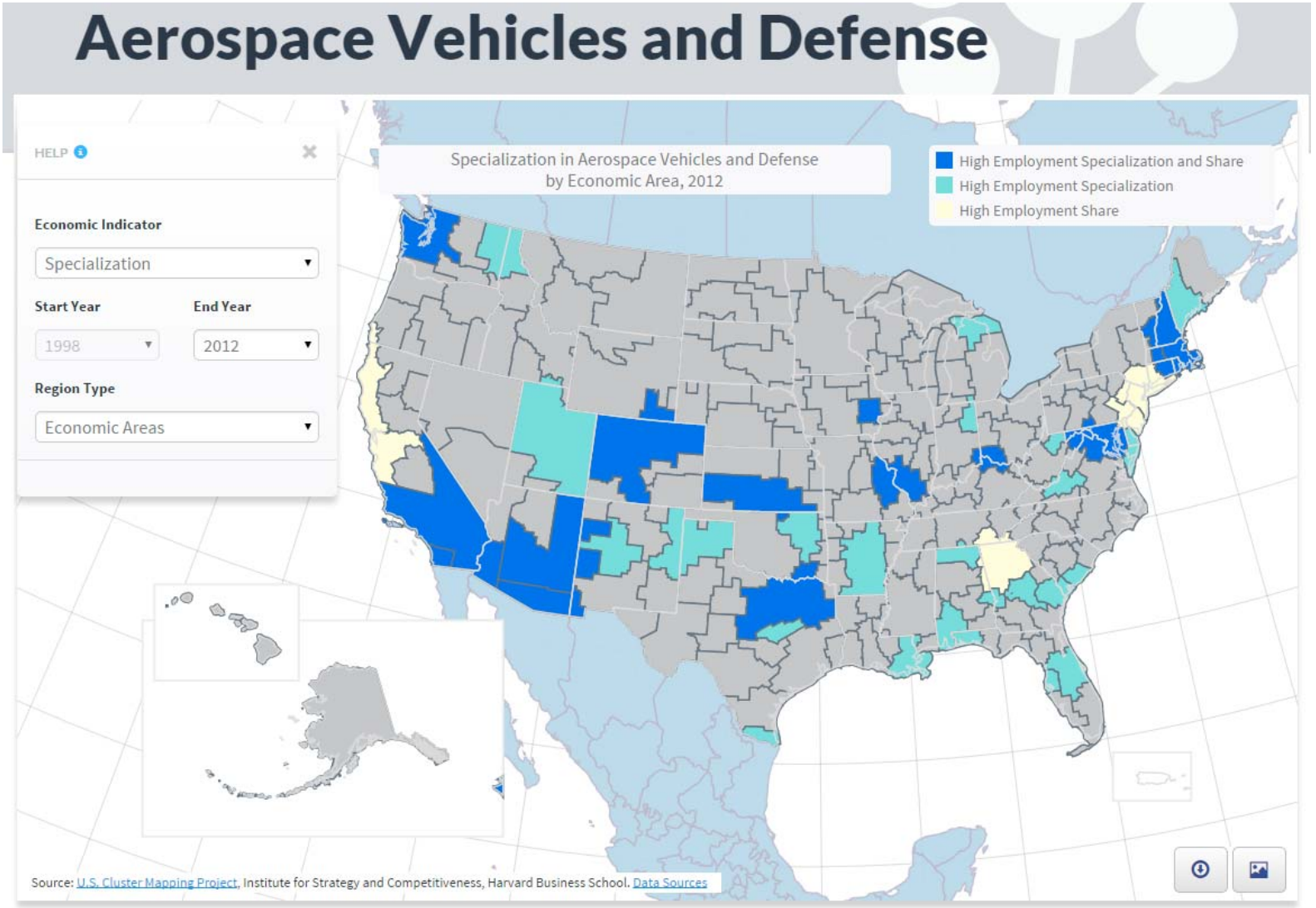
US Job Creation in Traded Clusters, 2009-2012



US Job Creation in Traded Clusters, 2009 to 2012



Each Cluster Can Be Mapped Into Regions: Mapping Strong Clusters



Benchmarking Regional Clusters: Aerospace Vehicles and Defense

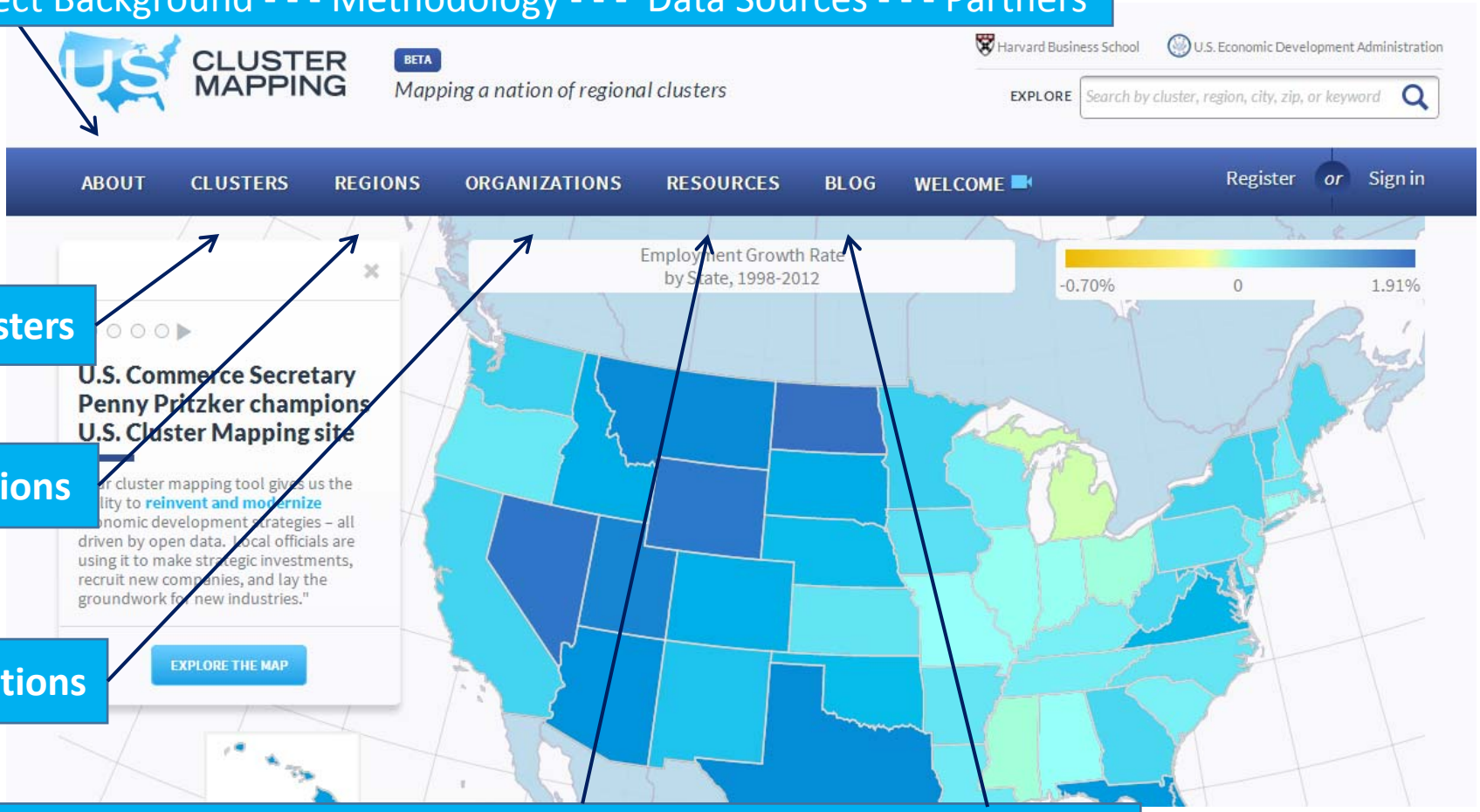
Region (EA)	Employment 2012	CAGR Employment 2001-2012	Specialization (LQ)	Establishments	Avg Wage 2012	Patents Issued, 2007-2011
Seattle-Tacoma-Olympia, WA	**70,099**	-4.4%	7.81	114	$70,169	1,285
Los Angeles-Long Beach-Riverside, CA	53,063	-4.8%	1.61	**324**	$90,527	**2,441**
Dallas-Fort Worth, TX	39,157	-0.3%	2.51	97	$62,550	899
Wichita-Winfield, KS	28,191	-4.2%	13.21	84	$69,597	43
Boston-Worcester-Manchester, MA-NH	26,357	-2.6%	1.50	66	**$93,668**	1,758
Phoenix-Mesa-Scottsdale, AZ	22,296	0.4%	3.09	74	$55,257	499
Washington-Baltimore-Northern Virginia, DC-MD-VA-WV	19,815	0.6%	1.09	42	N/A	755
Tucson, AZ	19,075	-1.8%	**13.98**	**15**	$84,507	164
Hartford-West Hartford-Willimantic, CT	18,322	-3.3%	4.30	84	$64,370	227
San Diego-Carlsbad-San Marcos, CA	16,468	**3.9%**	3.00	51	$83,060	1,077

Note: Selected Strong clusters (high specialization): top-10 by employment size.

Source: CBP and USPTO data

www.clustermapping.us

Project Background - - - Methodology - - - Data Sources - - - Partners



Clusters

Regions

Organizations

Research - - - - Policy Examples - - - - Case Studies - - - - News

Rich Data on Regional Performance & Drivers

- **Detailed data based on multiple databases: U.S. Census Bureau, USPTO, StatsAmerica, …**

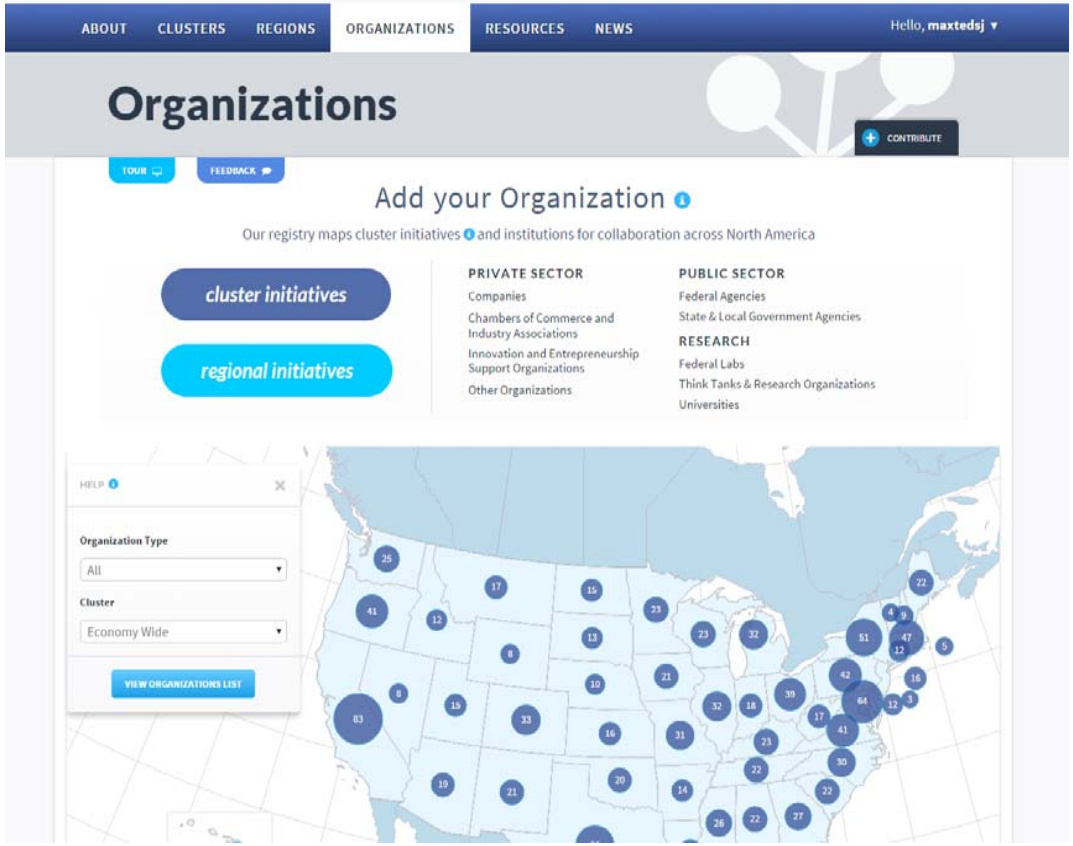
PERFORMANCE

BUSINESS ENVIRONMENT

DEMOGRAPHICS & GEOGRAPHY

- **Outcomes:** GDP per Capita, Average Wages, Labor Mobilization, Employment Growth, Unemployment, Poverty
- **Intermediate Outcomes:** Labor Force Productivity, Innovation, Exports, Growth Rate for Traded Establishments
- **Factor Input Conditions:** R&D Expenditure, Federal Funding for R&D, Venture Funding, Scientific Degrees Awarded, Advanced Scientific Workers, High School and College Degrees
- **Context for Firm Strategy and Rivalry:** Unionization, Tax Rates, Corporate Tax Rates
- **Related and Supporting Industries:** Regional Cluster Strength, Manufacturing Intensity
- **Population:** Demographic Structure, Overall and Young Adult Population Growth, Density, Domestic and International Migration
- **Neighborhood:** Prosperity of Neighboring Regions
- **Firm Demographics:** Average Traded Establishment Size, Headquarters of Fortune 1000 Firms

Linking Clusters to Local Institutions and Cluster Initiatives



Who are the Institutions for Collaboration in your region?

- The **new Organizations data** register cluster initiatives and other organizations
- Registered users can post resources and relevant news
- Facilitates connectivity among firms and supporting institutions

Clusters Going Forward

- Things **we can learn**: The tool as a platform

- Things **we can do**: Cluster-based economic development

- Things **we can create**: Dynamic tool

Things We Can Learn:
The Tool as a Learning Platform

- **New Action-Oriented Research Opportunities using the Tool**
  - Clusters and the Great Recession
  - Local versus Traded Clusters and Entrepreneurial Quality
  - Clusters and the Inner City
- **A Community of Practice to Develop Assessments of Individual Regions and Clusters**
  - Policy Evaluation
  - Role of Institutions for Collaboration (IFCs)

Things We Can Learn: Clusters and The Great Recession

- Using the new BCD data, we examine the **role of clusters in employment growth during the business cycle** in the context of the recent Great Recession (2003-2011)

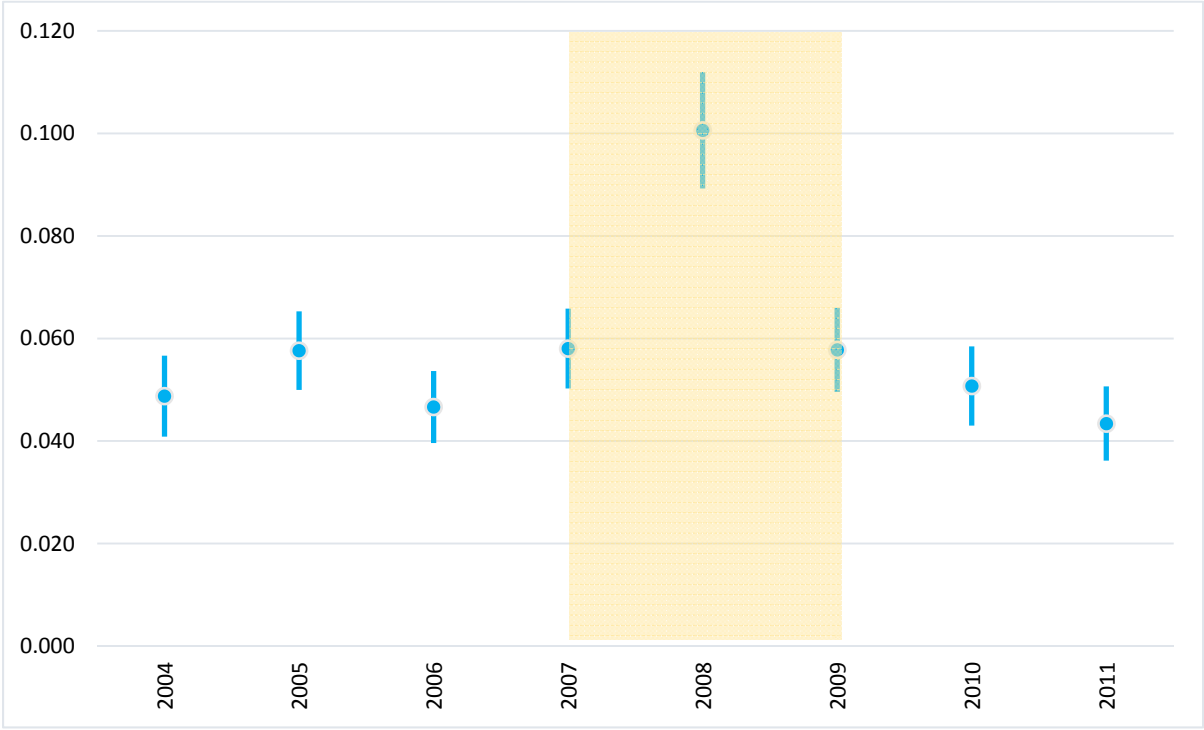
- Two opposing forces may be at work:
  - **Agglomeration** economies that arise in regions specialized in clusters (e.g., Delgado, Porter and Stern, 2010, 2012, 2014), and **could facilitate resilience and recovery from a recession**

  - However, **negative shocks could propagate among related industries**, and **could increase the depth of a recession** (Acemoglu et al., 2013)

Things We Can Learn: Clusters Can Improve Resilience

- We find a positive relationship between the employment growth of regional industries and the strength of their clusters, during the whole business cycle and specially during the crisis (2007-2008)

Estimated Effect of Cluster Specialization on
Region-Industry Annual Employment Growth, 2003-2011



Source: Delgado/Porter/Stern, 2014, "Clusters and the Great Recession," Working Paper

MARTIN TRUST CENTER FOR MIT ENTREPRENEURSHIP

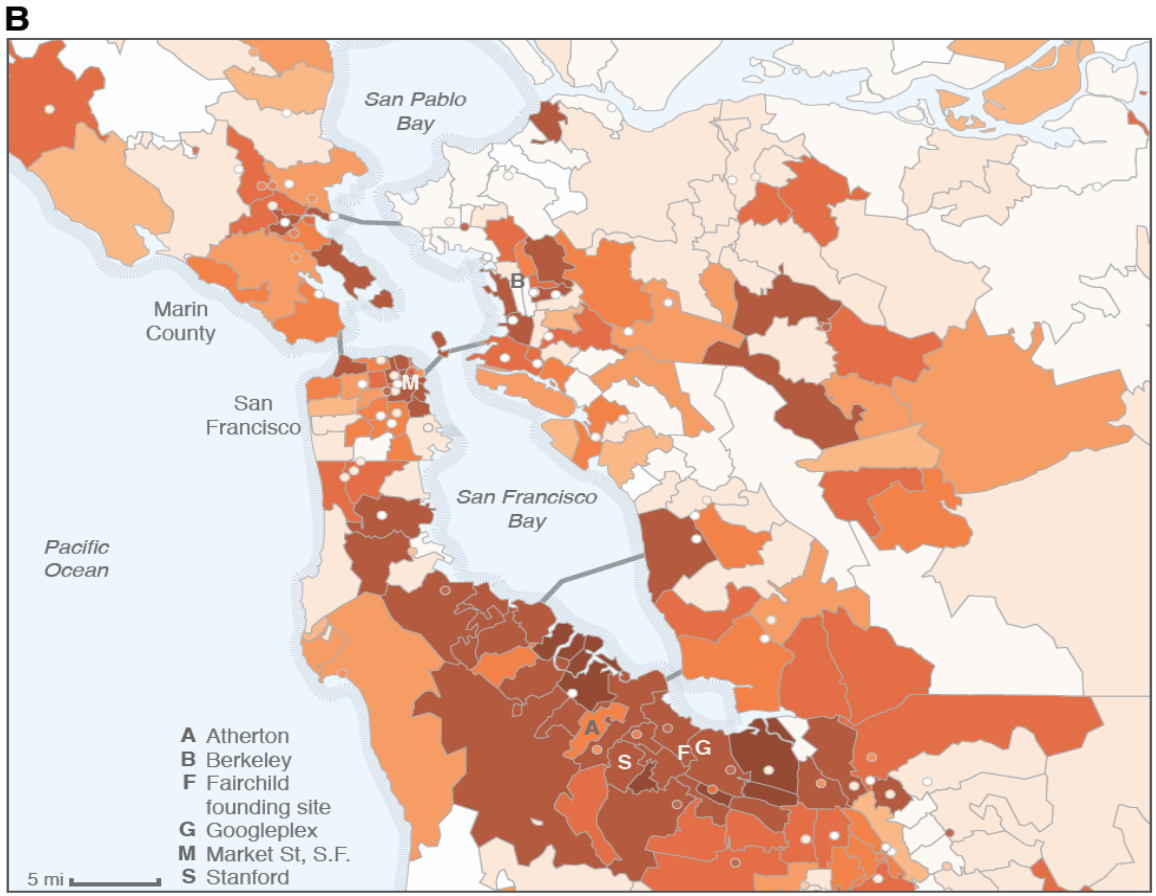
MIT REAP REGIONAL ENTREPRENEURSHIP ACCELERATION PROGRAM

Things We Can Learn: Clusters and Entrepreneurial Quality

- As part of the MIT Regional Entrepreneurship Acceleration Program, the need for a step change to measure the *quality* of start-ups within a region, on a real-time basis and at an arbitrary level of generality
- We combine "big data" (using comprehensive business registration records) with a predictive algorithm that assesses the likelihood of a meaningful growth outcome (e.g., IPO or high-value acquisition) based on observables available at the time of incorporation (e.g., the name, patents and copyrights, etc)
- Using the CMP Cluster Definitions, we are able to assign business names to "local" versus "traded" clusters based on the historical incidence of business names in particular clusters
- **Among other results, we find that that businesses within traded clusters are more than 4x more likely to achieve a meaningful growth outcome**

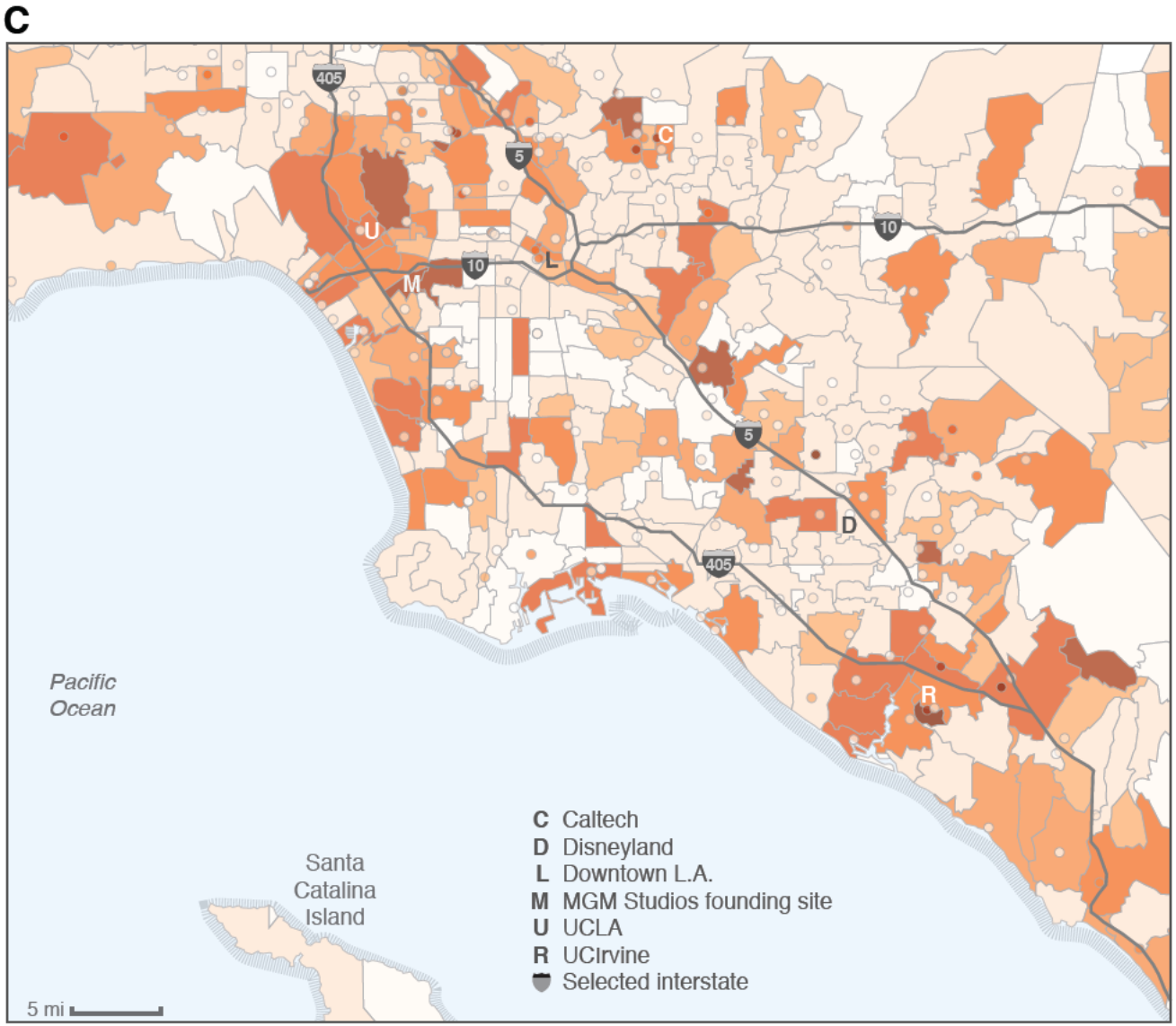
Source: Guzman and Stern, 2014, "Where is Silicon Valley?" Working Paper

Where is Silicon Valley?



Using complete CA business registration records, and novel algorithm to predict start-up success, this project uses CMP cluster definitions and local versus traded industry definitions to estimate entrepreneurial quality score by zip code across California

While per capita start-up quantity is similar in Los Angeles, a lower level of entrepreneurial quality than the heart of Silicon Valley



Things We Can Learn: Clusters and the Inner City

- **How do clusters matter at different levels of geographic aggregation?**

- Many cluster studies either focus on narrow geographic units (e.g, an industrial district or individual city) while others focus on the impact of clusters on regional economies (Delgado, Porter and Stern; Glaeser, etc)

- With Kim Zeuli and the Institute for Competitiveness in the Inner City, we are exploring whether the impact of the cluster environment is particularly important for inner cities
  - Are more dense areas within an economic region particularly sensitive to the cluster environment?
  - How does the cluster environment impact distressed economic regions?

Source: ICIC, JP Morgan Chase and Co.
"The Missing Link: Clusters, Small Business Growth and Vibrant Urban Economies"

Things We Can Learn: Policy Assessment

- **Assessment of specific economic development initiatives**
  - In recent work, Maryann Feldman and coauthors (2012, 2013) have worked with the EDA to assess projects such as the i6 Challenge, and the Jobs and Innovation Accelerator Challenge (JIAC) Project.
  - **Success Metrics**: Moving beyond aggregate outcome measures such as employment and investment, novel Capacity Based Measures based on the connectivity among firms and supporting institutions.
  - **Benchmarking Approach**: To examine changes in clusters and regions before and after policy initiatives, specification of a control group of "similar" regional clusters based on CMP definitions.

Source: Feldman/Reed/Lanahan/McLaurin/Nelson/ Reamer, 2012, "Innovative Data Sources for Economic Analysis

Clusters Going Forward:
Things We Can Do

Things We Can Do

- **Use the data for cluster-based economic development**
  - How is your region doing? How are your peer regions doing?
  - What clusters are you strong in? And your neighbors?
  - What is the positioning in your clusters? Emerging Clusters?
- **Engage and contribute to the community of practice**
  - Who are the Institutions for Collaboration in your region? How are they already working together? How might they work better together?
  - How do the cluster initiatives in your region relate to the cluster composition of your region? How can we leverage regional strengths as a source of economic development?

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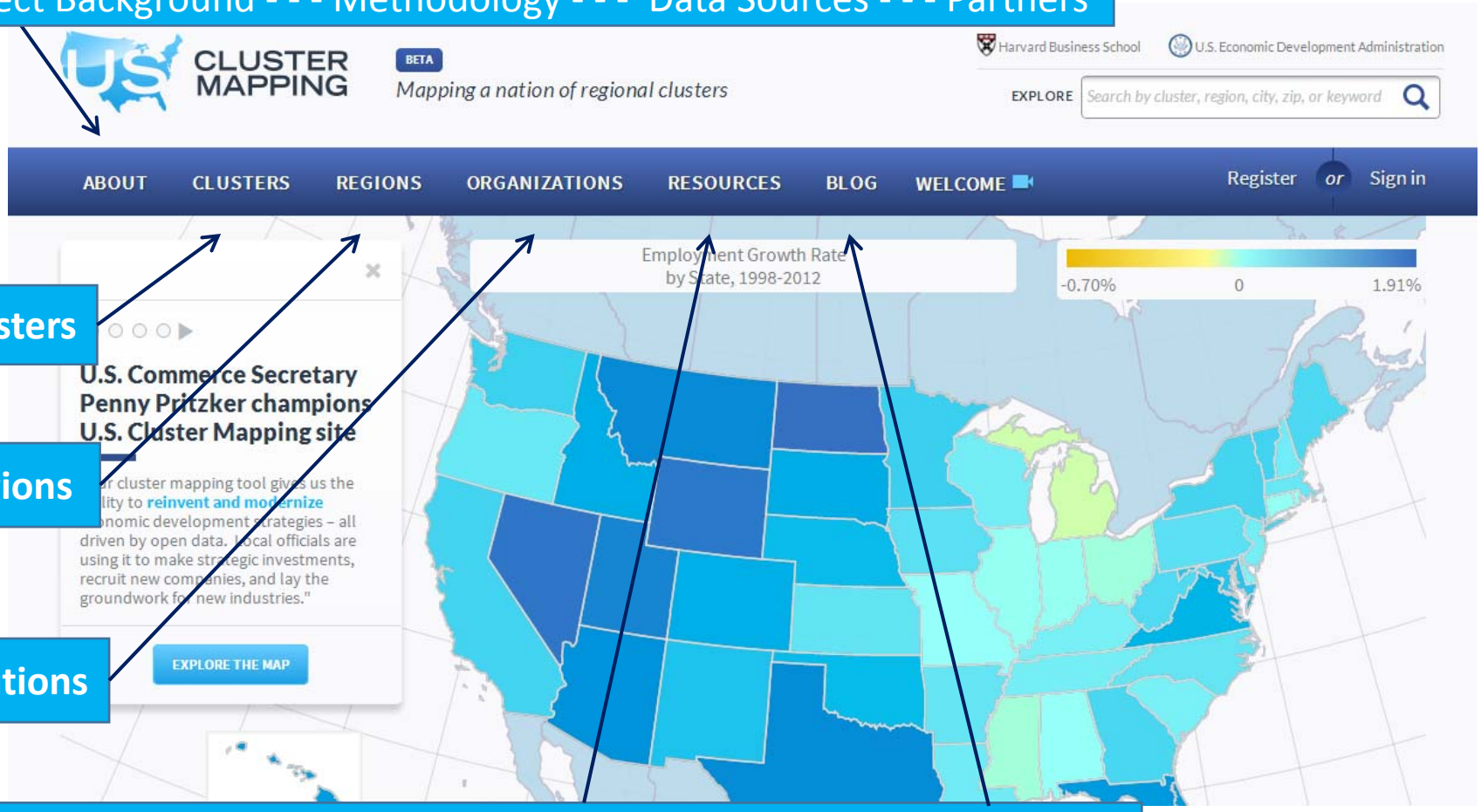
Project Background - - - Methodology - - - Data Sources - - - Partners



Clusters

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Organizations

Research - - - - Policy Examples - - - - Case Studies - - - - News

Policy Guides and Studies

- By developing policy guides and policy and impact studies (available on www.clustermapping.us), the U.S. Cluster Mapping Project provides new insights on the role of clusters in driving regional economic outcomes


POLICY GUIDE

CLUSTER MAPPING

TIPS AND TRADECRAFT FOR PRACTITIONERS:

Engaging the Private Sector to Improve Regional Prosperity

KURT DASSEL, PARTNER, MONITOR GROUP

Winter 2013

Competition across regions is rising—what works to sustain prosperity growth?

Regions across the U.S. are facing a challenging economic environment. Aggregate demand and job creation are returning, but at a slow rate, as the repercussions of the global financial crisis still linger in many parts of the country. Competition between regions, both within the U.S. and with areas abroad, has intensified. Companies and markets have become much more global in recent years, influencing the locations where economic activity takes place. This creates opportunities for many U.S. regions, but it also raises the bar on performance.

With macroeconomic conditions unlikely to provide sufficient impetus for growth and rivals increasingly active, regions are in search of a formula to address key policy issues that they now face: What are the proven policies, programs, and industries that foster the creation of more jobs and higher wages? Is there a specific workforce-training program that will best prepare people for the economy of the 21st century? Is there a good model for an incubator or accelerator that will consistently increase the number of startups in a region? Are there particular growth industries of the future—perhaps information technology, biotech, or clean tech—that will lead to prosperity? What kind of tax cuts and economic policies will encourage companies to invest and grow their businesses? Are there low-cost but effective incentive packages that will entice firms to locate in a particular region?

Unfortunately, there are no easy answers. Regions are different and so are their needs. Therefore, there is no one-size-fits-all solution to the challenge of economic development. However, there are ways of moving toward the right answer. Put another way, what works is establishing an effective system for identifying the unique economic development needs of a region and efficiently deploying existing infrastructure and resources in light of those needs. This guide sets out to explain how.

How Regions Grow

Understanding what works starts with an understanding of what spurs more jobs and higher wages. Jobs and wages come to a region when the companies in that area compete and win in the marketplace.[1] Companies in these areas find a growing demand for their products that they can profitably meet. To capture profits, they hire more workers and increase production. An important part of economic growth, therefore, is about allowing companies to become more profitable by helping them grow revenues, cut costs, or do both.

Individuals and organizations in any given region are constantly taking actions that affect the ability of companies to grow revenues or cut costs. They urge governments to levy taxes for roads, bridges,

There is no one-size-fits-all solution to the challenge of economic development.

schools, healthcare, and quality of life amenities. Governments in turn pass various laws and regulations on zoning, permitting, and licensing. However, they also do the opposite. They lower taxes and streamline laws and regulations. They cut spending on infrastructure, education, workforce training, and research and development.

Regardless of the specifics, these actions can have both a positive and negative impact on the ability of companies to create and sustain profits. Even a choice of taking no action—of "doing nothing" or "staying out of the way of business"—affects companies. Essentially, inaction is a decision to accept the status quo on the current system of taxes, regulations, schools, roads, bridges, and everything else that matters. Since all action and inaction will inevitably affect companies, the trick is to figure out how to have the most positive impact. Determining the strategy for a specific region is not a simple task, however, as each has different strengths and weaknesses in its business environment.

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Clusters Going Forward:
Things We Can Create

Core Project Partners

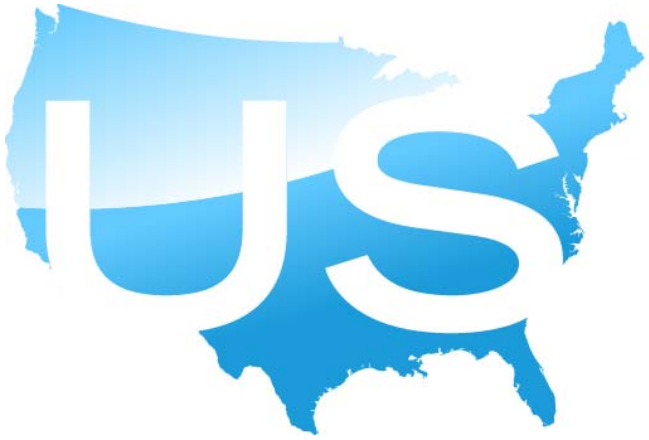
Things We Can Create

- This conference is a milestone in the evolution of the community of practice of cluster researchers and practitioners

- The Cluster Mapping Project has already brought together researchers, practitioners, and policymakers to design, develop and test a robust and transparent cluster mapping tool

- The future of the Cluster Mapping Project is limited only by our creativity, and our commitment to move this agenda forward together
  - Serving as a transparent, robust, and timely source of data for cluster development efforts
  - Connecting the ever-growing community of cluster organizations, both in the United States and abroad
  - Serving as the hub to track cluster-led economic development efforts, identify best practice, and diffuse new data and insights

- Accelerating economic and social progress through a new generation of research, collaboration, and action



CLUSTER MAPPING

Let's get started together!