



# The Value of Real-time Labor Market Data for Macroeconomic Research

NABE Webinar: Using Big Data to Measure Labor Market Trends

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*Bledi Taska, PhD*

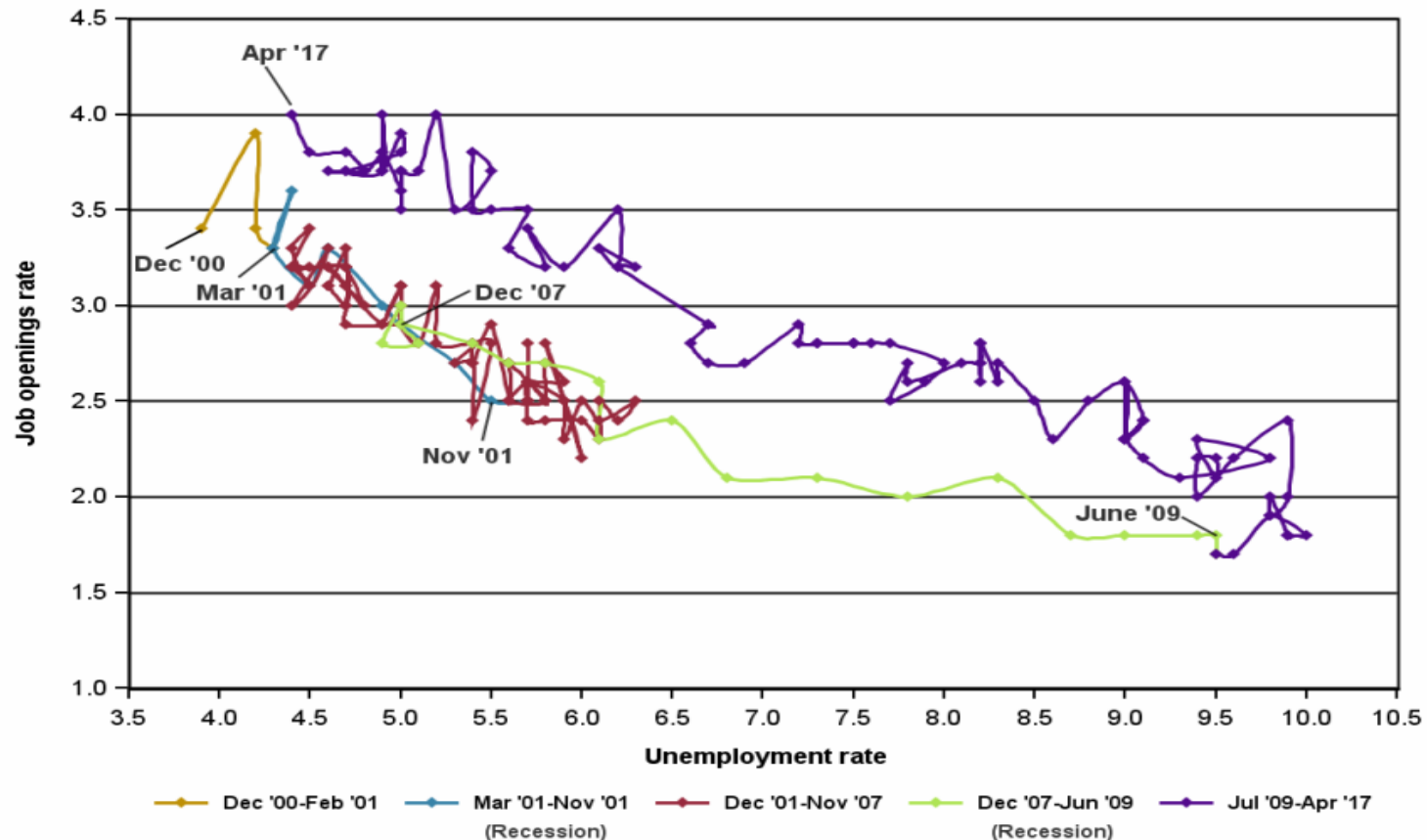
*Chief Economist, Burning Glass Technologies*

# Presentation Summary

- 1. The shift in the Beveridge curve and the concept of “Mismatch Unemployment”**
- 2. Description of real-time labor market data**
- 3. Examples of how economists have used the data to answer related questions**
- 4. Reasons why macroeconomists have not fully embraced real-time data**
- 5. Addressing the main reasons and describing a model that improves the properties of real-time data**

# Since the Last Recession we Have Observed a Rightward Shift in the Beveridge Curve

The Beveridge Curve: Seasonally Adjusted



Source: Bureau of Labor Statistics, Current Population Survey and Job Openings and Labor Turnover Survey, June 6 2017

# Mismatch Between Vacancies and Workers is a Possible Explanation

1. **Sahin et al. (2014):** Find that mismatch can potentially account for one-third of the increase in the unemployment rate during the Great Recession
2. **Restrepo, P. (2015):** Develops a theoretical model and shows that when the mismatch between the skill requirements in the available jobs and workers' current skills is severe, labor markets go through a prolonged adjustment process
3. **Macaluso, C. (2017):** Suggests the concept of local skill remoteness to capture the degree of dissimilarity between the skill profiles of workers and jobs in a local labor market

**Only the Sahin et al. paper uses real-time labor market data to estimate mismatch**

# Collecting Real-Time Labor Market Data

**Real-time job market data offer up-to-date insights not possible through traditional sources**

**Visit Online Job Sites**

**Collect & Deduplicate Job Postings**

**Read Postings to Generate Detailed Data**



**Laboratory Technician**

Bayer MaterialScience (BMS) is one of the leading producers of polymers and high-performance plastics in North America and is part of the global Bayer MaterialScience business with nearly 14,700 employees at 30 sites around the world. Business activities are focused on the manufacture of high-tech polymer materials and the development of innovative solutions for products used in many areas of daily life. The main segments served are the automotive, electrical and electronics, construction, medical, and sports and leisure industries.

**Job description** The primary responsibility of this role is to produce and evaluate foam samples in the laboratory to support flexible foam application development. Bayer MaterialScience (BMS) product quality control, customer technical support, polyol, isocyanate and process research & development programs, and flexible molded and slabstock foam research & development programs.

**The incumbent will:**

- Producing lab-scale foams, testing of polyols, isocyanates and additives for customer technical programs, process and product research programs and manufacturing support.
- Troubleshooting and maintaining equipment needed for bench foam production and routine foam processing & properly evaluation and supporting machine scale-up work.
- Maintaining appropriate logs/notebooks and other records including computer documents utilizing Excel, Word and PowerPoint programs to support project work.
- Provide internet and other information searches as needed for problem solving.
- Performing stoichiometric calculations for foam production using computer programs or hand-calculations.
- Understanding and following EHS, SOPs and Responsible Care rules, regulations and guidelines while maintaining good housekeeping and a safe work environment through participation in safety programs.
- Capable of managing multiple tasks, working effectively with more than one technical supervisor, interfacing with other functions such as manufacturing and research personnel, interfacing directly with customers if needed, and providing timely foam results to assure the satisfaction of customers if needed, and providing timely foam results to assure the satisfaction of customers if needed, and providing timely foam results to assure the

- Job Title & Occupation
- Employer & Industry
- Technical Skills
- Foundational Skills
- Certifications
- Educational Requirements
- Experience Levels
- Salaries

# Real-Time Labor Market Data is Big Data

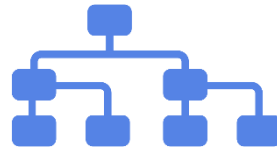
**40,000+ sources**  
**700 MILLION jobs**  
**250 MILLION resumes/year**



**Drawing conclusions**  
Insight from in-demand skills and real-life career patterns



**A common language**  
Proprietary Dynamic taxonomy for comparisons



**Tagging and structuring**  
70+ elements of metadata



**Capturing job market data**  
3.4 million active, unique jobs daily

# Recent Papers have Suggested that Skill Demands of Employers are Changing Across the Business Cycle

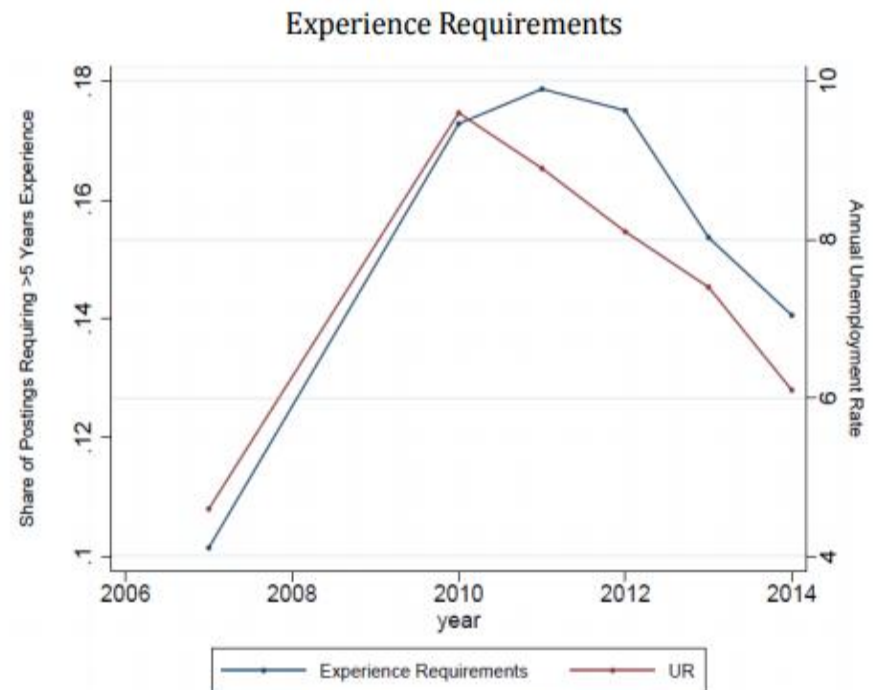
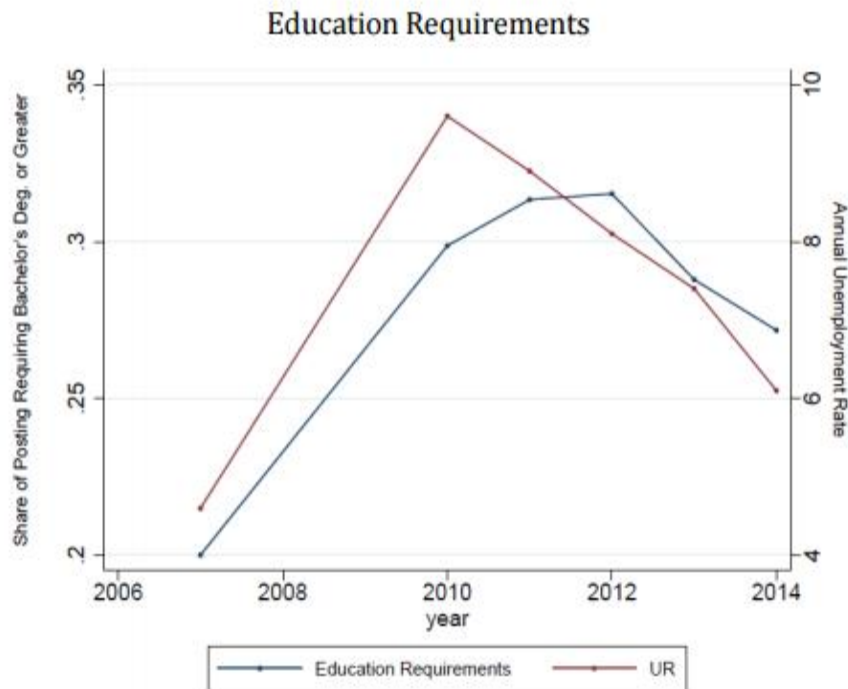
## ECONOMISTS ARE STARTING TO USE BIG DATA AND LOOK UNDER THE HOOD

1. **Hershbein, B. and Kahn, L. B. (2016):** Demonstrate that skill requirements in job vacancy postings differentially increased in MSAs that were hit hard by the Great Recession (87 million online job postings)
2. **Modestino, A.S., Shoag, D. and Ballance, J. (2016):** Find that during the Great Recession a significant share of employers engaged in “upskilling”—raising the education requirements for a given job, in part to take advantage of the weak labor market (82.5 million online job postings)
3. **Wardrip, K., Fee, K., Nelson, L. and Andreason, S. T. (2015):** Show that the upskilling phenomenon differs significantly across geographies and this affects the availability of “opportunity” occupations (62 million online job postings)

**All these papers are using real-time labor market data**

# Business Cycle and Upcredentialing

## Relationship Between Changes in Employer Requirements and Labor Market Slack, 2007-2014



From: Modestino, Alicia Sasser, Daniel Shoag, and Joshua Ballance. "Downskilling: changes in employer skill requirements over the business cycle." *Labour Economics* (2016).



# Additional Important Questions that can be Answered Using Real-Time Labor Market Data

- 1. How does mismatch differ by geography? Did the states that were hit harder by the Recession face a higher mismatch?**
- 2. How does mismatch differ by occupation group? What are the implications for education policy?**
- 3. How do other important policies, such as minimum wages or “ban the box,” affect mismatch between employers and employees?**

**In spite of the richness of the research questions that can be answered by real-time labor market data, macroeconomists have not fully embraced this type of data**

# Real-Time Labor Market Data are Still Not Being Utilized to Full Extent by Macroeconomists

## Main Reasons:

1. **Availability and cost**
2. **Perception about aggregate representativeness and consistency**
3. **Benchmarking against external data sources**
4. **Some bias in types of jobs posted and noise in time trends (modeling needed)**

## Availability and Cost

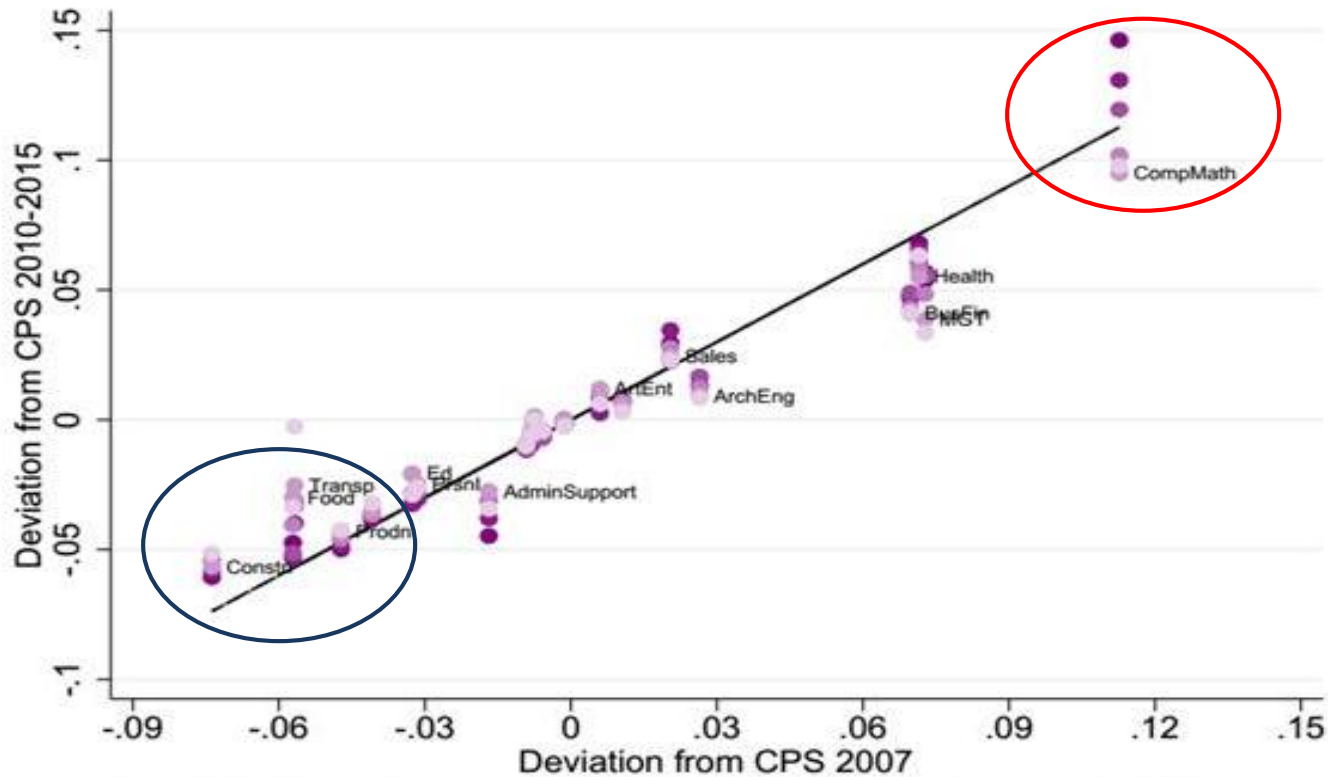
- 1. Burning Glass collaborates with academic researchers from most of the largest universities in US (for example Harvard, MIT, Yale, Upenn, Stanford, Northwestern, NYU, Brown, and Duke)**
- 2. Many of our academic collaborations are pro-bono and we provide constant support to all researchers**
- 3. We have also collaborated with several research organizations, such as Federal Reserve Bank of Philadelphia, Brookings Institution, W.E. Upjohn Institute, and OECD**

# Representativeness

1. Carnevale, A.P., Jayasundera, T. and Repnikov, D. (2014): Using 2013 data, estimate that between **60 and 70 percent** of job openings are now posted on the Internet
2. They also find that job ads are biased toward industries and occupations that seek **high-skilled, white-collar workers**
3. Using data for from 2015-2017, and utilizing the same methodology as above, we find that **online job postings represent** approximately **80 percent** of the US labor market

# Representativeness Over Time is Stable and Improving

Comparison of BGT Posting Distribution Across Occupation Groups to New Jobs Distribution from the Current Population Survey (CPS) Over Time

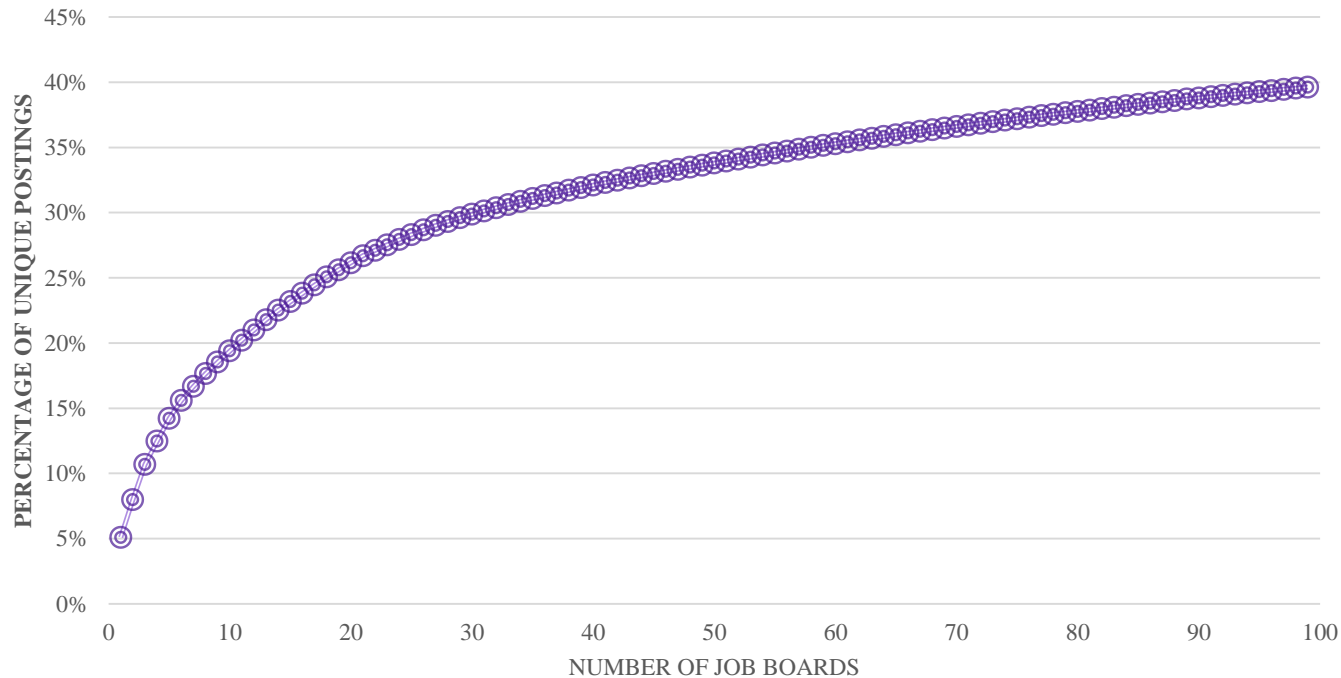


Note: The x-axis shows the BGT posting percentage in an occupation group in 2007 minus the CPS new job percentage in the same occupation group in 2007. The y-axis shows the differences each year from 2010 to 2015; darker shades are earlier years, lighter shades are later. This figure is taken from “Hershbein, B. and Kahn, L.B., 2016. Do Recessions Accelerate Routine-Biased Technological Change? ”.

# Consistency is Ensured by Aggregating from Multiple Sources

**Cajner, T and Ratner, D. (2016):** Suggest that interpreting the measure of job vacancies from real-time data requires careful consideration of changes in the quickly-evolving market for online job postings

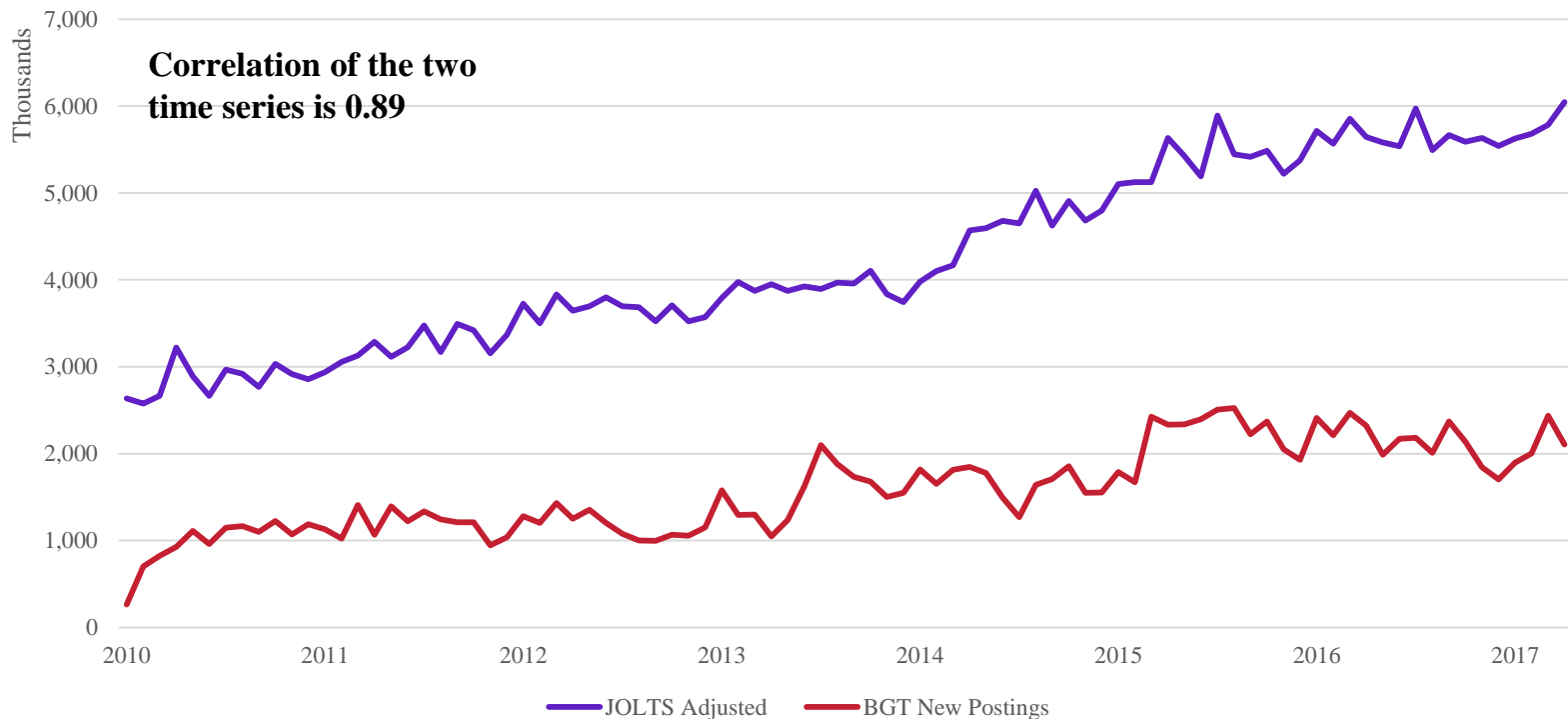
**Cumulative Distribution of Total Unique Postings Collected from the Top 100 Job Boards**



**Note:** Burning Glass collects data from more than 40,000 sources. The largest source of BGT data accounts for no more than 5% of the total, while the top 100 largest sources account for less than 40% of the total.

# Benchmarking against other data sources (JOLTS)

**Figure 5: JOLTS and Burning Glass Data  
(January 2010-April 2017)**



**Note: Burning Glass data cannot be directly compared to JOLTS, because of differences in the collection method. Burning Glass data represents only new postings which are collected for a specific month, while JOLTS data includes openings which could have also existed in previous months.**

# Distribution Bias and Over-Time Behavior

1. Although in the aggregate the data behaves well, there is still some distributional bias. There are blue-collar occupations which are underrepresented in online postings (for example construction workers)
2. Distributional bias is not extremely important when you are trying to understand the **composition of labor demand**. Nonetheless, it is important when you need the **correct level** of the labor demand (supply-demand model).
3. The time trend of online-postings is affected by three sources
  - a) The true trend of the labor market
  - b) Employers' participation in the online-market
  - c) Changes in aggregation technology



# Normalized Openings

1. Normalized openings are a modeled version of real-time posting, which can be considered as the best available proxy of labor demand (by **SOC**, **NAICS**, and **County**, and **time**)
2. We use a proprietary model, which utilizes Census and Bureau of Labor Statistics data to adjust the level and trend of real-time postings data
3. More specifically, the model utilizes the following third party data (and components) to estimate and validate the model:
  - a) Job Openings and Labor Turnover Survey (**JOLTS**): Monthly job openings by industry
  - b) Occupational Employment Statistics (**OES**): Employment by state, occupation, industry, and year
  - c) The Quarterly Workforce Indicators (**QWI**): Employment and hires by state, industry, year, and quarter
  - d) The Bureau of Labor Statistics (**BLS**) **Occupational Projections**
  - e) Job Vacancy Surveys (**JVS**) from several states

# Validation of Model: Aggregate Statistics (Job Vacancy Rate)

	JOLTS	Normalized Openings	Normalized Openings (by Industry and State)	Normalized Openings (by State and Occupation)
<b>Mean</b>	4.0%	4.1%	4.3%	4.4%
<b>Median</b>	3.4%	3.4%	3.4%	3.6%
<b>Min</b>	1.2%	1.2%	0.8%	0.05%
<b>Max</b>	10.6%	10.6%	24.6%	128.8%

# Validation of Model: Comparison of Occupational Distribution with Job Vacancy Survey

Year	State	Occupational Family	Distribution Normalized Openings	Distribution JVS	Distribution OES Employment
2015	Michigan	Management Occupations	6.0%	2.8%	4.9%
	Michigan	Business and Financial Operations Occupations	5.6%	5.2%	4.4%
	Michigan	Computer and Mathematical Occupations	4.3%	3.1%	2.5%
	Michigan	Architecture and Engineering Occupations	4.2%	5.0%	3.1%
	Michigan	Life, Physical, and Social Science Occupations	1.0%	0.8%	0.7%
	Michigan	Community and Social Service Occupations	1.8%	1.5%	1.4%
	Michigan	Legal Occupations	0.9%	0.2%	0.6%
	Michigan	Education, Training, and Library Occupations	3.8%	3.5%	5.8%
	Michigan	Arts, Design, Entertainment, Sports, and Media Occ	1.9%	2.5%	1.3%
	Michigan	Healthcare Practitioners and Technical Occupations	8.0%	7.7%	6.3%
	Michigan	Healthcare Support Occupations	3.2%	5.2%	3.3%
	Michigan	Protective Service Occupations	1.6%	1.8%	1.8%
	Michigan	Food Preparation and Serving Related Occupations	10.7%	13.4%	9.0%
	Michigan	Building and Grounds Cleaning and Maintenance Occu	2.4%	5.7%	3.1%
	Michigan	Personal Care and Service Occupations	4.0%	3.3%	2.8%
	Michigan	Sales and Related Occupations	9.0%	10.0%	10.3%
	Michigan	Office and Administrative Support Occupations	13.4%	10.2%	15.1%
	Michigan	Farming, Fishing, and Forestry Occupations	0.1%	0.1%	0.1%
	Michigan	Construction and Extraction Occupations	1.8%	3.6%	2.9%
	Michigan	Installation, Maintenance, and Repair Occupations	3.8%	4.3%	3.9%
Michigan	Production Occupations	6.8%	5.0%	10.4%	
Michigan	Transportation and Material Moving Occupations	5.7%	5.2%	6.3%	
<b>Correlation with JVS</b>			<b>0.88</b>		
<b>Correlation with OES Employment</b>			<b>0.94</b>	<b>0.81</b>	

# Validation of Model: Comparison with BLS Projected Openings

SOC Code	SOC Name	Normalized Openings	BLS Projected Annual Openings (New Method)	Normalized Openings Rank	BLS Projected Annual Openings Rank (New)
412031	Retail Salespersons	1,966,403	665,031	1	1
353021	Combined Food Preparation and Ser	1,795,428	590,457	2	2
434051	Customer Service Representatives	1,435,312	301,543	3	8
353031	Waiters and Waitresses	1,280,549	462,934	4	4
533032	Heavy and Tractor-Trailer Truck Dr	1,207,328	191,448	5	15
412011	Cashiers	1,194,348	581,966	6	3
399021	Personal Care Aides	1,097,406	289,849	7	9
436014	Secretaries and Administrative Assis	1,069,083	242,272	8	10
439061	Office Clerks, General	1,061,193	337,268	9	5
537062	Laborers and Freight, Stock, and Ma	1,015,215	332,320	10	6
352014	Cooks, Restaurant	764,802	176,797	11	16
435081	Stock Clerks and Order Fillers	713,335	215,881	12	11
411011	First-Line Supervisors of Retail Sale	654,209	168,229	13	18
351012	First-Line Supervisors of Food Prepa	608,247	134,354	14	24
499071	Maintenance and Repair Workers, C	593,953	114,202	15	30
311014	Nursing Assistants	583,502	191,823	16	14
433031	Bookkeeping, Accounting, and Audit	576,726	168,989	17	17
413099	Sales Representatives, Services, All	572,602	94,117	18	32
372011	Janitors and Cleaners, Except Maids	569,223	306,344	19	7
414012	Sales Representatives, Wholesale ar	569,151	148,838	20	20

**Note: Burning Glass data cannot be directly compared to BLS projected openings because of differences in the collection method. BLS do not include churn (movement of employees from occupation A to occupation A), which is a large component of online postings.**

# Validation of Model: Comparison with BLS Projected Openings

BA Plus Occupation	Correlation of Normalized Openings and BLS New Projections	Correlation of Normalized Openings Rank and BLS New Projections Rank
1	0.86	0.90
0	0.95	0.92

# Conclusions

- 1. Real-time labor market data can be used to answer important policy questions**
- 2. Although academic researchers have started using real-time labor market data, macroeconomists are not fully utilizing these type of data**
- 3. Contrary to common perception, some properties of real-time labor market data are well understood**
- 4. We need the academic community to push the boundaries of understanding and utilizing big data even further**