

Advancing Our Understanding of Engineering Education Pathways, Employment Dynamics, and Economic Impact through the Innovative Use of Administrative Data



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What Happens When You...

- Enroll in high school?
- Register to take your SATs?
- Apply to a college/university?
- Accept an employment offer?
- Pay your taxes?

An administrative record is created!



Overview

- Administrative data: definitions and challenges
- Examples of value: Michigan and USM
- Potential relevance
- Future value and recommendations



Administrative Data are Ubiquitous

- Multiple data fields are collected for disparate administrative reasons
 - Cost of collecting data is already built-in
 - Data is updated reliably and regularly (sometimes continuously)
 - If part of a system, collected in a consistent way
 - Cost to assemble/consolidate data is relatively small
- Covers samples and timespans not financially or logistically achievable through survey methods
 - Provides data on individuals who would not normally respond to surveys, with high coverage of population
 - Repeated collection of similar data from other sources may not be feasible



Challenges of Administrative Data

- Significant data privacy concerns
 - Not unique to administrative data
- Very limited control over the data collection
 - Largely limited to data required for administrative purposes
 - Data must be connected to answer specific questions
- Dataset precision determined by lowest quality source data
 - Completion is dependent on relevance of data to administrator
 - Subject to changes in administrative procedures
- Up-front investment required for data access and authorization
 - “Owner” of each data source must understand benefits of authorizing data use to support outcomes of project
 - “Owner” of each data source must understand benefits of providing access to data



Linkage of Administrative Data is Imperative to Realizing its Value

- Linking datasets requires system of personal identity codes across datasets
 - Data is used in aggregate, not individually
- Other fields are successfully implementing and scaling use of administrative data
 - Science and Technology for America's Reinvestment: Measuring the Effect of Research on Innovation, Competitiveness and Science (STAR METRICS)
 - Modeling Income in the Near Term (MINT)

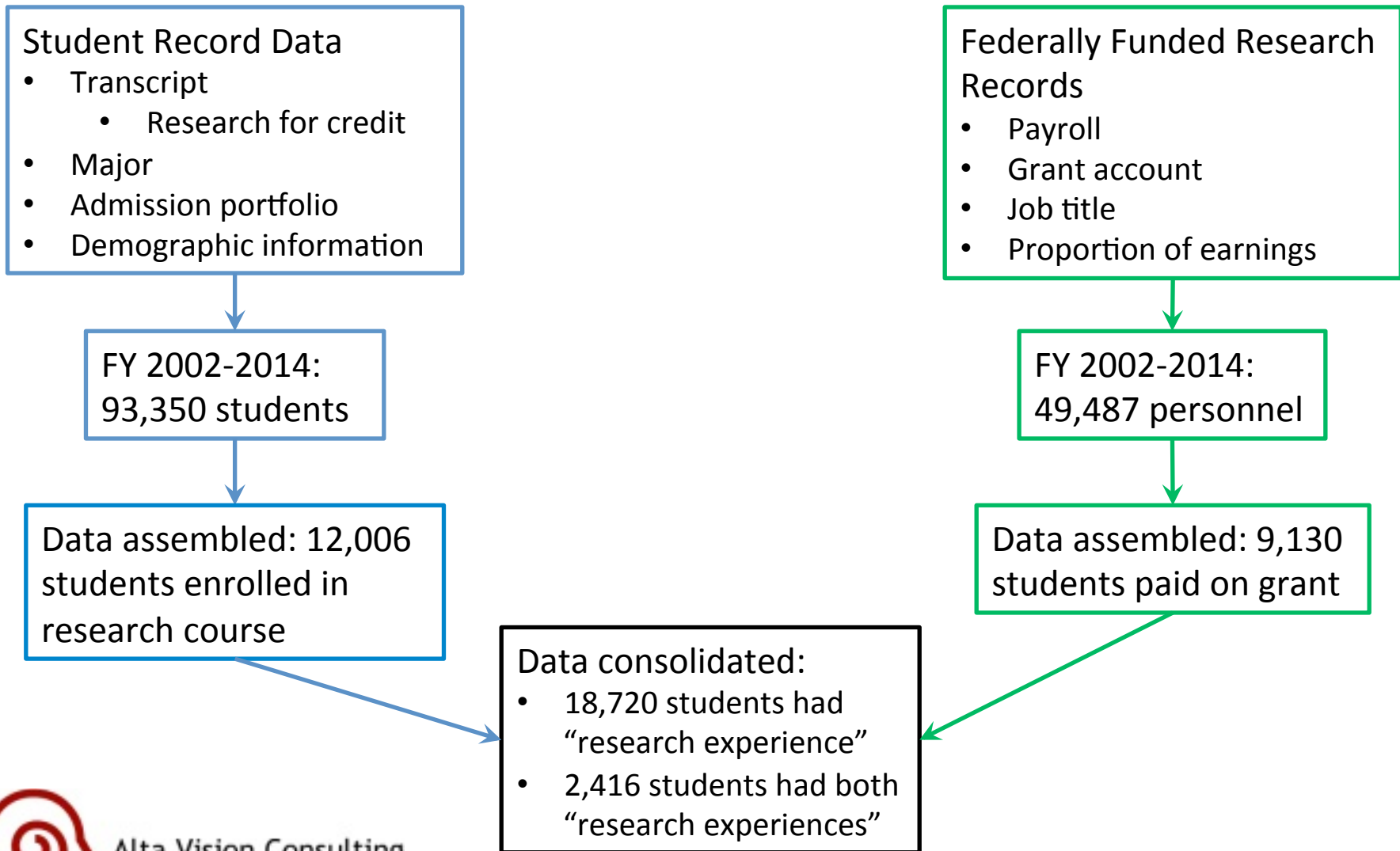


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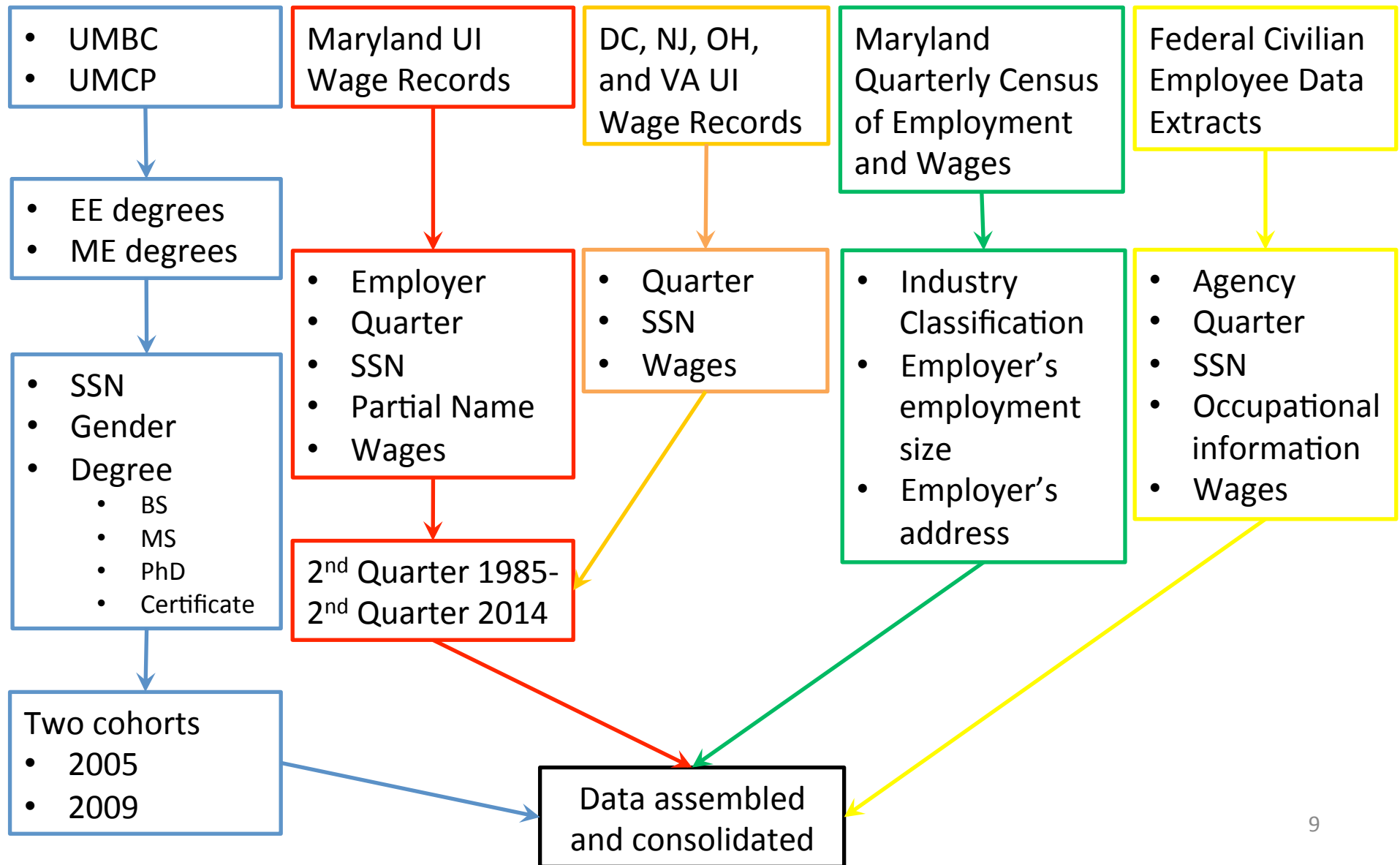
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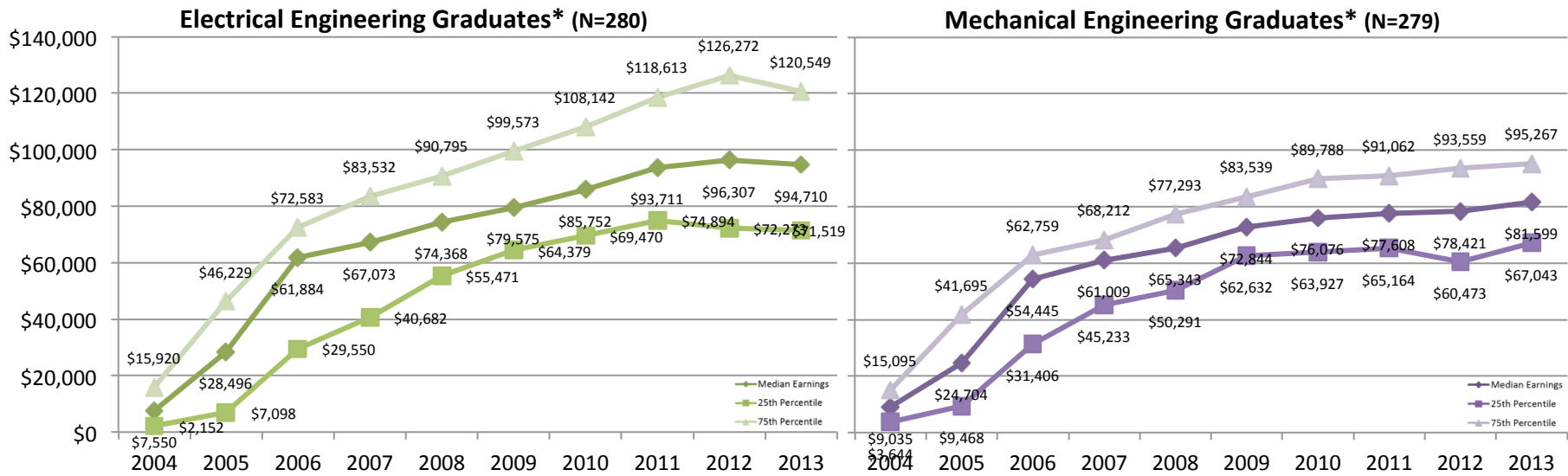
Probing Impact of Research Experiences on Retention and Persistence at University of Michigan



Probing Engineering Graduate Wages from University System of Maryland



FY 2005 University System of Maryland Engineering Graduates



*Source: University System of Maryland

**Source: Jacob France Institute, Maryland UI Wage Records, DLLR. Earnings have been adjusted for inflation (U.S. DOL Bureau of Labor Statistics CPI for 2013).

Administrative Data Relevant to Engineering Education/Workforce

K-12 Student Record

- Enrollment/ graduation dates
- Attendance
- Demographic information
- Coursework
- Grades

Test Scores

- PSAT/SAT/ACT scores
- AP/IB Test scores
- GRE/MCAT/LSAT

Federal Grant Records

- Agency
- Institution (awardee)
- Primary Investigator

Application Records

- Financial aid status
- SAT/ACT/GRE
- AP/IB credit
- Demographic information

College Student Record

- Enrollment date/gaps
- Graduation date
- Enrollment/ dropped courses
- Declared major/minor
- Grades
- Demographic information

Employment Records

- Unemployment Insurance Tax
- Social security
- Wages

Census records

- Occupational classifications
- Wages
- Employment
- Demographic information

Federal Civilian Employment Records

- Personnel
- Salaries
- Dates of employment

College/University Records

- Faculty course assignments
- Grant award records
- Special Program records

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Insight into Engineering Education Migration Patterns with Administrative Data

- Does high school coursework in math/science impact engineering enrollment and persistence? Is there a core set of courses which correlates with persistence?
- Do demographic factors correlate with engineering enrollment and persistence?
- Once a major is declared, where do students go who transfer out of engineering? Do they successfully graduate in those majors?
- Are certain college courses gateway courses? Are certain professors gateway professors?
- Have engineering postsecondary migration patterns changed over time? Have institutional efforts to impact engineering migration patterns worked?



Insight into Engineering Employment Choices with Administrative Data

- Does undergraduate coursework in engineering/other impact post-graduate employment?
- How many engineering graduates are employed engineers within 6 months of graduation? As non-engineers?
- Which demographic factors correlate with employment in/outside of engineering after graduation?
- Do credentials (certificates, majors, and certifications) impact wages after graduation?



Insight into Engineering Employment Dynamics with Administrative Data

- What are the migration patterns in employment post-graduation after 5 years? 10 years? 20 years?
- What are the academic backgrounds of employed engineers?
- How do wages compare across engineering majors working in different sectors and fields?
- Does undergraduate preparation impact wages after 5 years? 10 years? 20 years?
- What role does continuing education play in the careers of employed engineers?



Insight into Engineering Economic Impact with Administrative Data

- What is the economic impact of engineering graduates? How does it compare to other graduates?
- Where is the geographic economic impact of engineering graduates?
- Is there a geographic relationship between a graduate's college/university and his/her site of employment?
- How many patent applications can be attributed to engineering graduates?



Power of Scaling: Insight into Engineering Educational Pathways with Administrative Data

- Does K-12 student preparation impact undergraduate persistence?
- Is there a core set of undergraduate courses which correlate with undergraduate persistence?
- Are there undergraduate interventions, or combinations of interventions, which correlate with persistence?
- Does institutional environment impact student persistence?
- Do different subpopulation persist differently in different institutional environments?



Power of Scaling: Insight into Engineering Employment Dynamics with Administrative Data

- Does undergraduate preparation/major/other credential impact long-term post-graduate employment? Wages?
- Do different subpopulations have long-term post-graduate differences in employment? Wages?
- How does geography impact post-graduate employment? Wages?
- How does institution/program type impact post-graduate employment? Wages?



Power of Scaling: Insight into Engineering Economic Impact with Administrative Data

- What is the national economic impact of engineering graduates?
- Where is the national geographic economic footprint of engineering graduates?
- How are engineering graduates contributing to the creation of new businesses and jobs?
- Do multiple colleges/universities with engineering programs create synergy in their economic impact on regional economies? On the national economy?
- What is the economic impact of continued education and professional development of employed engineers?



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Innovative Use of Administrative Data will Directly Impact...

- **Engineering education practice**
 - Faculty/Administration will have a clear gauge of student success in engineering *compared to sister institutions*
 - Colleges/universities will gain new, real-time understanding of student migration and retention in engineering
- **Interventions in undergraduate retention in engineering**
 - Identify successful models in retention and persistence in engineering for replication
 - Determine if/when different subpopulations make different educational and career choices



Innovative Use of Administrative Data will Directly Impact...

- **Industry/Employers**
 - Understand employee pathways into and out of their business/industry
 - Understand direct connection between a private investment and impact on regional/national economy
- **Policy-makers**
 - Understand economic impact of engineering graduates on their relevant region/sector
 - Offers a tool with clear impacts to advocate for increased investment in engineering education



Preliminary Recommendations

- Pilot use of administrative data sources to explore connections between engineering education and workforce dynamics
 - Support projects at the university system level
 - Support projects at the state/regional level
- Provide incentives for academic institutions to provide access to their administrative data
 - Support development of an independent clearinghouse to collate, protect and aggregate data
 - Support development of an interface showcasing linked public datasets relevant to higher education
 - Support the development of an interface for participating stakeholders to gain confidential, individualized reports

