Opportunities and Considerations for the Use of Big Data Techniques in the Consumer Expenditure (CE) Survey

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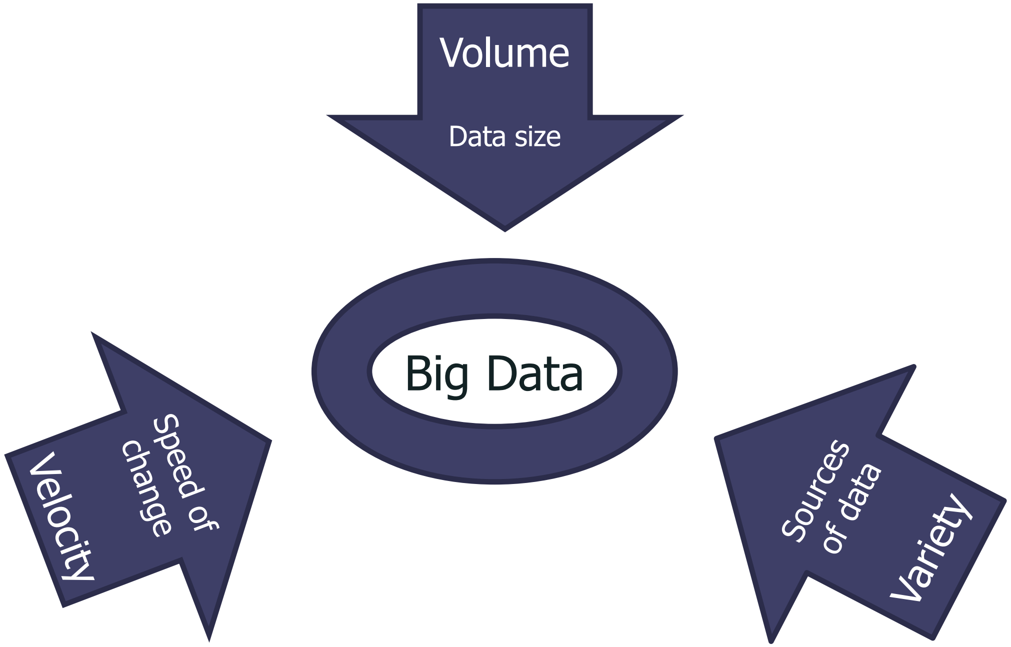
Outline

1. Background on CE Survey and big data
2. Administrative data as type of big data
3. Respondents' data source preferences
4. Techniques
    a. Record linkage
    b. Web scraping
    c. Text analysis
5. Summary

1. Background

- CE Survey: National household panel survey that collects information about spending habits of consumers
- CE being redesigned to limit measurement error, reflect new behaviors and technology
- Big data can benefit survey (improve accuracy, reduce respondent burden)

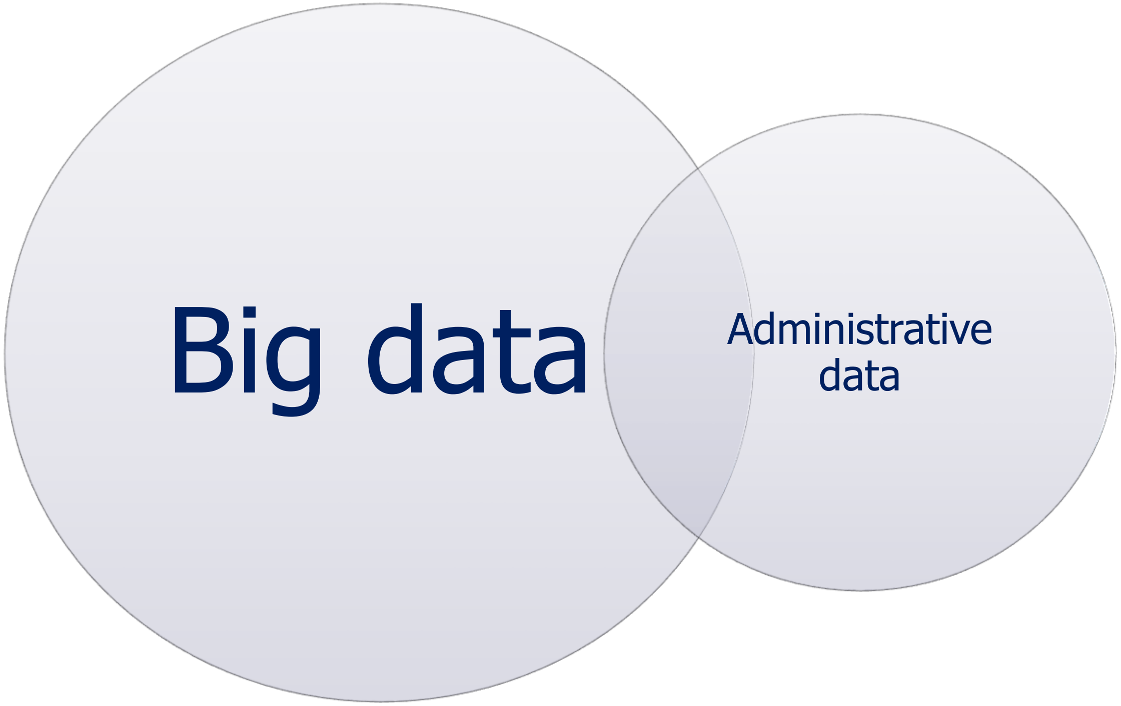
Big Data


Volume
Data size
Big Data
Velocity
Speed of change
Variety
Sources of data

Big Data

- Collection and Analysis Aspects:
  - Data storage (databases),
  - Tools used (APIs, MapReduce)
  - Capabilities (text analysis, record linkage, visualization)

2. Big data and Administrative data



Big data and Administrative data

- Commonalities
  - Origin – data incomplete and not tailored to survey needs
  - Volume – massive data sets of population members

- Differences
  - Variety – admin records usually structured, not arising organically from individuals
  - Database – relational database (SQL) vs. non-relational (NoSQL)
  - Selection – smaller problem of non-coverage

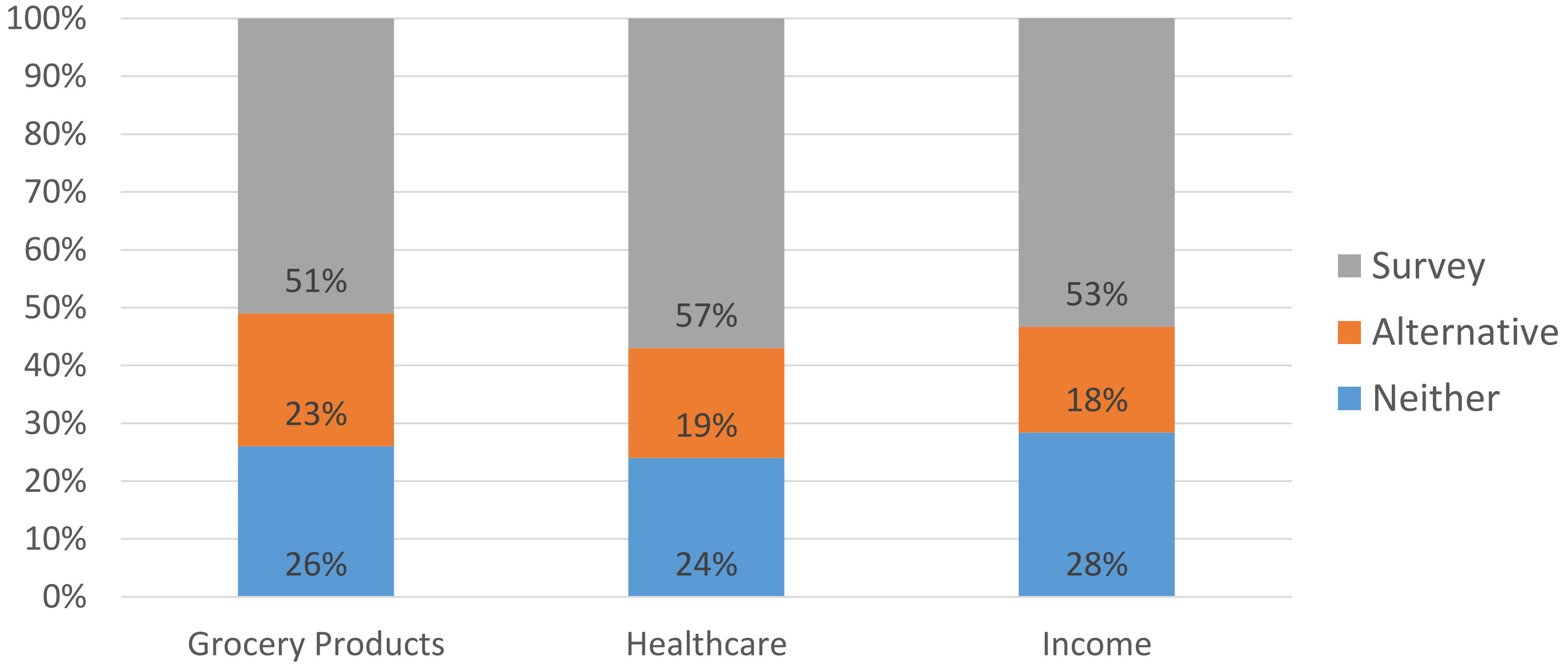
3. Data Source Preferences

- Research question asked of respondents finishing last CE Survey interview:

*"If you knew your name and other information would never be singled out and would only be used for statistics, **would you prefer that the BLS ask you about the cost of products you buy in a survey or use commercial records**, like grocery store loyalty cards? [with 'neither' response option]"*

- Similar questions for
  - healthcare services: survey, doctor or hospital, neither,
  - income information: survey, IRS, or neither

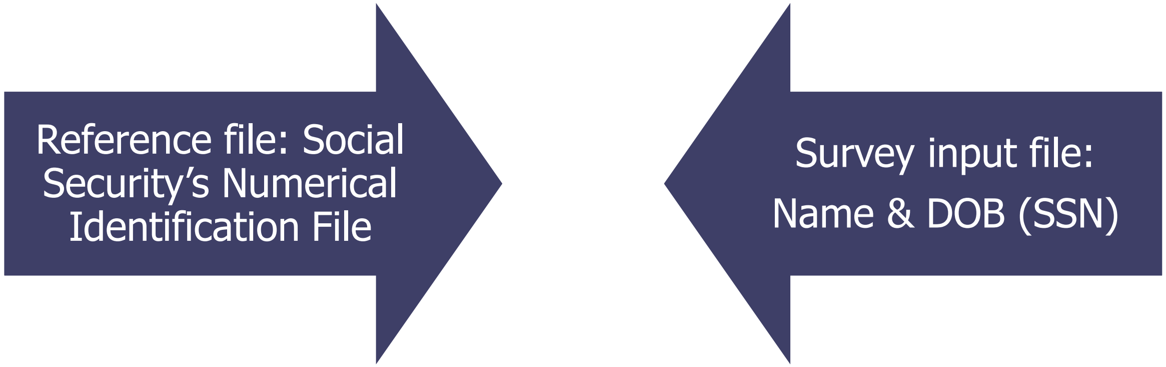
Similar Preferences for Survey Collection



4. Techniques: Admin Record Linkage

- Privacy concerns related to linkage can be addressed
- Census can use administrative records without respondent consent if protected from further disclosure, used for statistical purposes (Gates, 2011)
  - Census has given notification when linking data (CPS)
- CE Survey respondents may be receptive to linkage
- Census' Person Identification Validation System (PVS) links survey responses with records

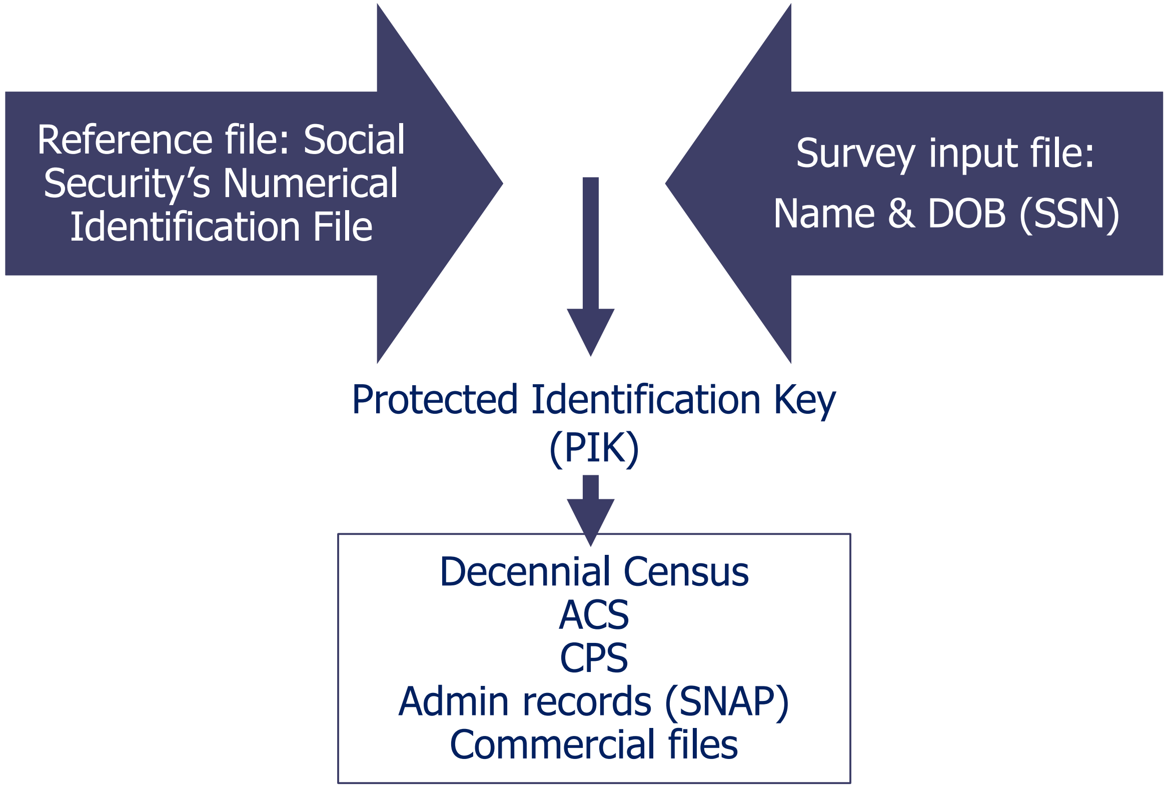
Linkage Process: PIK Assignment


Reference file: Social Security’s Numerical Identification File

Survey input file:

Name & DOB (SSN)

Linkage Process: PIK Assignment



Reference file: Social Security's Numerical Identification File

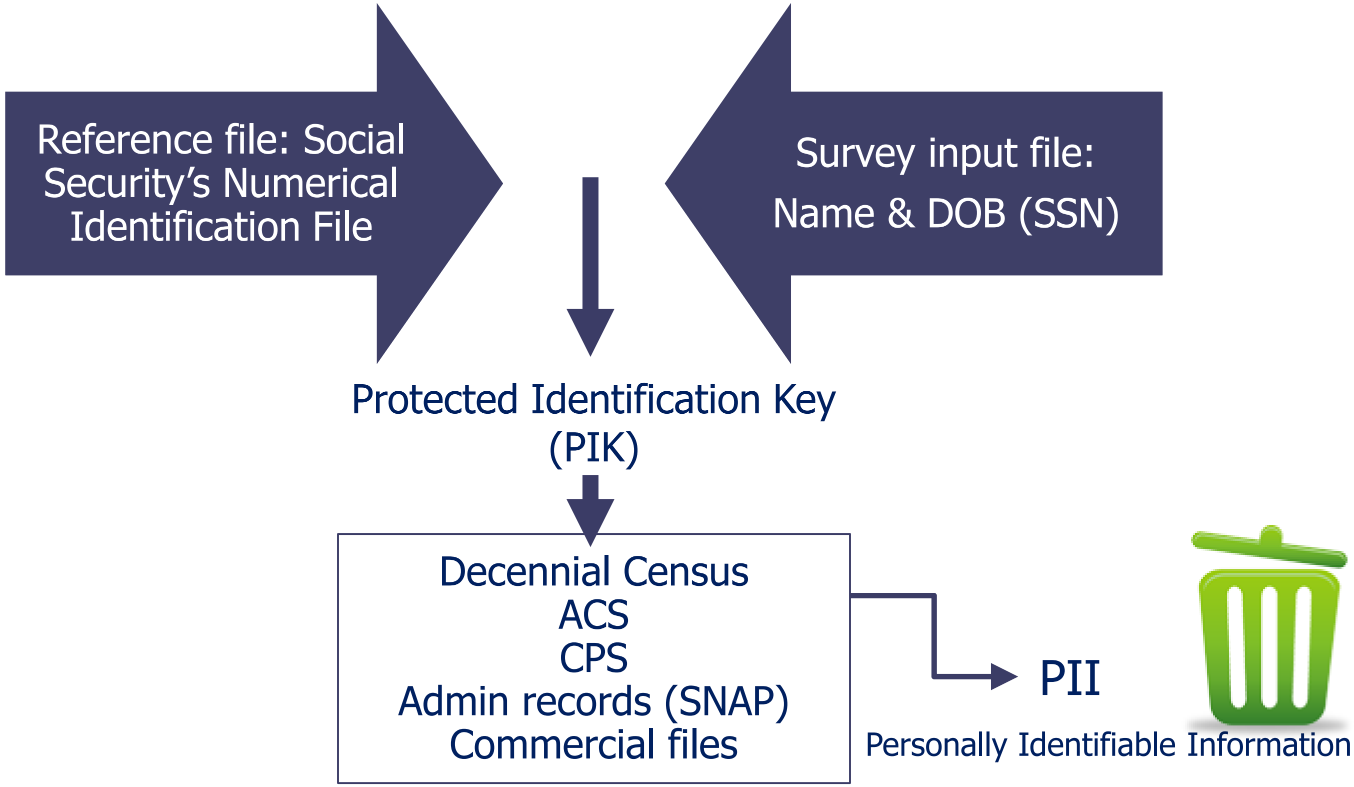
Survey input file:

Name & DOB (SSN)

Protected Identification Key (PIK)

Decennial Census
ACS
CPS
Admin records (SNAP)
Commercial files

Linkage Process: PIK Assignment



Reference file: Social Security's Numerical Identification File

Survey input file:

Name & DOB (SSN)

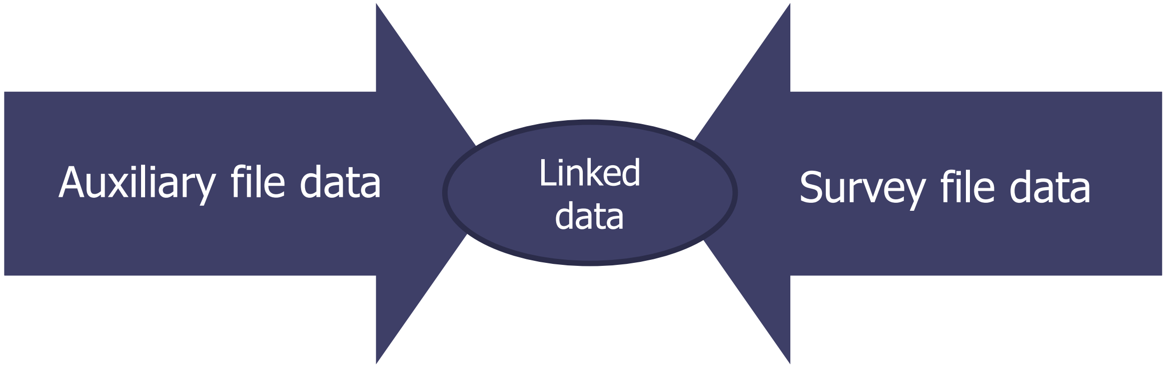
Protected Identification Key (PIK)

Decennial Census
ACS
CPS
Admin records (SNAP)
Commercial files

PII

Personally Identifiable Information

Linkage Process: PIK Assignment



Linkage Process: Incomplete Data

- Not all sample units on input file matched
- Having more information on input file (e.g., SSNs) facilitates higher match rates
- Probabilistic method allows setting threshold for failure to match
- Contingencies needed for survey units unmatched to administrative data

Linkage Process: Uses for CE

- BLS would need to negotiate access to Federal tax information
  - Link to IRS income data - substitute to income questions
- SNAP state participation data - improve accuracy/minimize underreporting
- ACS - validate housing, vehicle reports
- Public housing records - rent payment information

Techniques: Web Scraping

- Pursue tool for scraping home value estimations
- Permit burden reduction & accuracy improvement
- Challenges: Sites (e.g., Zillow) have APIs, facilitating the sharing of website information, but prohibit storage of scraped data, other non-API methods of scraping
- Agreements may be needed to allow non-commercial scraping of websites with property data (private or government)

Techniques: Text Analysis

- Named entity extraction – recognition of entities (e.g., Person, Organization)
- CE Diary contains text expenditure descriptions which need converting into predefined codes
- Potential to use classifiers to assign words to certain codes with probability

5. Summary

- New opportunities for sourcing respondent-collected data
- Administrative data structured to permit matching to sample units, but like big data, may be incomplete
- Interact with agency supplying data to ensure data received is the data expected
- Other techniques – scraping, text analysis – improve data quality and process data more efficiently

Contact Information

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