

# Paradata and Adaptive Design: Examples from BLS

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# Overview

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- What are paradata?
- What is adaptive design?
- Adaptive design for establishment surveys
  - ▶ Comparisons to household survey implementations
  - ▶ Features of establishment surveys for adaptive design
- The BLS experience
  - ▶ Availability and analysis of paradata in estab. surveys
  - ▶ Recent efforts and future directions
- Questions for the committee

# What are paradata?

- Empirical data about the process of producing a survey statistic
- Can be captured at every survey stage
- Provide information about quality of survey operations and the data they produce
- Examples:
  - ▶ Case management system data (e.g., contact history, interview/travel time, mode of collection, etc.)
  - ▶ Indicators of quality (e.g., r-indicators, % missing info)
- Auxiliary data
  - ▶ Frame data on size, industry, MSA, etc.
  - ▶ Data that can be linked from other surveys

# Motivation for Adaptive Approaches

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- In practice, the survey environment often is difficult to predict
- Increasing concern over rising costs and potential bias in survey estimates
- Interest in optimizing quality given costs constraints by tailoring designs during collection

# Adaptive Survey Design

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- Assumes that different sampling units may receive different treatments
- These treatments are defined before the start of survey, but they can be updated based on accumulating data observed during collection
  - ▶ Similar ideas are manifest in double sampling and two-phase designs
- Decisions are intended to improve the error and cost properties of the resulting statistics

# Components of an Adaptive Design (AD)

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- Identify survey design features potentially affecting the cost and error structures of survey statistics
- Identify indicators of cost and error structures of those features
- Monitor indicators during data collection
- Based on decision rule, actively change survey design features in subsequent collection period
- Combine data from across designs/periods to produce a single estimator

# Potential benefits of AD

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- Pre-specified and fixed optimal designs are almost never achieved in practice
- Addresses issues associated with survey heterogeneous target populations
- Formalizing decisions enables better tracking of survey costs and errors
- Can help contain rising costs that are common in later stages of data collection
- Can offer evidence of reduced non-response and possibly other non-sampling errors

# Adaptive Designs for Establishment Surveys

- Differences between Establishment and HH surveys
  - ▶ Added steps in response process (e.g., Willimack and Nichols, 2010)
    - Selection and identification of the respondent
    - Assessment of priorities
    - Retrieval of information from existing records
    - Release of data
  - ▶ Population distributions
    - 1% of private US companies have more than 250 employees, but these companies contain nearly half of all employees covered by UI
    - Size of reporting unit impacts sampling, burden, NR efforts
  - ▶ Focus on quick estimators and estimates of change
    - Economic conditions can change rapidly -> frequent updates
    - Recurring surveys with *births* and *rotating out* cases
  - ▶ Rich frame data



# AD for Estab. Surveys, cont.

## ■ Design features that may affect cost and quality

- ▶ Collection mode
  - ▶ Collection materials
  - ▶ Level of effort
  - ▶ Incentives
  - ▶ Interviewers
  - ▶ Respondent rules
- } Likely less effective for estab. surveys

## ■ Factors affecting decision to implement AD

- ▶ Stability in business factors, respondents
- ▶ Fielding period, length of cycles
- ▶ Sample design
- ▶ Resource availability
- ▶ Availability of paradata, auxiliary data, and cost data

# Cost Information in Establishment Surveys

- Few cost models developed for establishment surveys
  - ▶ Differences in contact modes/mechanisms across surveys
  - ▶ Sharing trips (cases within a survey, between surveys)
  - ▶ Inadequate cost data
- Identify key cost drivers (variable costs)
  - ▶ PV: travel costs and personnel costs per establishment
  - ▶ PH: # of contact attempts and completes per establishment
  - ▶ Need to capture charge codes for specific activities by interviewer characteristics (e.g., supervisor/non)
- Develop average cost per sampled establishment

# The BLS Experience

- 2 types of BLS establishment surveys
  - ▶ Fed-State cooperative programs
    - State employees responsible for data collection
  - ▶ Directly-collected programs
    - Data collected by BLS employees
- Data collection:
  - ▶ Initial contact for detailed data collection (*initiation*)
  - ▶ Brief, periodic follow-up contacts to collect most current data (*update collection or repricing*)
- Collection methodologies vary
  - ▶ State programs – initiation often by mail, phone updates by State staff
  - ▶ Compensation/Pricing – initiation by PV by BLS staff, updating done by web/phone/mail

# Auxiliary Data and Paradata at BLS

- Auxiliary data available for BLS establishment surveys
  - ▶ Quarterly Census of Employment and Wages (QCEW) serves as the sampling frame for most BLS establishment surveys
    - Current Employment Statistics (CES); Occupational Employment Statistics (OES); Survey of Injuries and Illnesses (SOII); National Compensation Survey (NCS); Occupational Requirements Survey (ORS)
    - Derived from State Unemployment Insurance (UI) admin. tax records

Select Variables on QCEW Frame	
Employment size	Total quarterly wages
Missing, imputed or poor quality employment or wage data	
Industry	Central office collection
State, MSA, BLS region, address	Multi-unit firm
Age of establishment	Respondent in other BLS surveys

# Auxiliary Data, cont.

- Data captured in prior survey cycles
  - ▶ E.g., sample size by state/strata, mode, type of form sent/used, final disposition, estimates, size and direction of revisions, variances, etc.
- Data from external sources
  - ▶ Periodic surveys of State employment workforce agencies
    - States vary in sample size and administrative procedures
    - E.g., OES survey asked about BLS-funded FTEs, # of staff/managers, staff tenure, data collection practices, NRFU procedures, administration problems (Phipps and Jones, 2007)
  - ▶ Demographic and economic data sources (e.g., Census)

# Paradata Available for BLS Establishment Surveys

- Data from current cycle
  - ▶ Mode(s), edit failures, item nonresponse, mail/receipt/processing dates, call-back dates/reasons
  - ▶ Limited process data available through web collection portal
    - Internet Data Collection Facility (IDCF)
      - Edit failures, access/submission dates, respondent information
      - Push for greater use by respondents
      - Push for additional development/use of IDCF paradata (e.g., audit trails, frequency of changes in respondents, response changes, timing, etc.)

# Web-based Collection for BLS Establishment Surveys

- IDCF collection, 2013

BLS Program	% of Collection
Current Employment Statistics (CES)	20%
International Pricing Program (IPP)	72
National Compensation Survey (NCS)	9
Occupational Employment Statistics (OES)	17
Producer Price Index (PPI)	25
Survey of Occupational Injuries and Illness (SOII)	76

# Cost Information for BLS Establishment Surveys

- Some cost information for non-PV collection

Example: CES Collection Rates and Cost by mode, Average 2011

<b>Mode</b>	<b>Collection rates at first release</b>	<b>On-going collection cost, per unit</b>
<b>CATI</b>	90.8%	\$10.38
<b>TDE</b>	84.6%	\$2.88
<b>EDI</b>	59.2%	\$.50
<b>FAX</b>	85.8%	\$5.86
<b>WEB</b>	78.5%	\$2.40
<b>Other</b>	Varies	Varies

- Lack of good cost information for field staff

- ▶ Fed-State – no standardized tracking system; states do not systematically collect contact history
- ▶ BLS has fixed staff for some collection activities – not *variable costs* per se
- ▶ Data capture and case management systems not integrated with systems that capture travel/miles, production (interview durations, write-up times) <sup>16</sup>



# Recent Efforts That Inform AD in BLS Establishment Surveys

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- Adaptive design briefings with BLS survey programs
- OES Mode Study
- OES Postcard Test
- Factors affecting OES response
- Modeling nonresponse/nonresponse bias in OES
- IPP

# Adaptive Design Briefings

- 2011 outreach/briefings with senior managers/staff in each BLS program office on AD principles and applications
- Key findings:
  - ▶ Many existing procedures had AD “flavor,” but these are not well documented (how paradata are used in decision-making)
  - ▶ Time, resource, system constraints make real-time estimation difficult
  - ▶ Lack of systematic paradata, data on incremental costs, variance, etc.
  - ▶ Field would like more information about when they can stop “working” a case (stopping rules), when to switch modes, which cases to target
- Examples of BLS research that inform AD approaches . . .

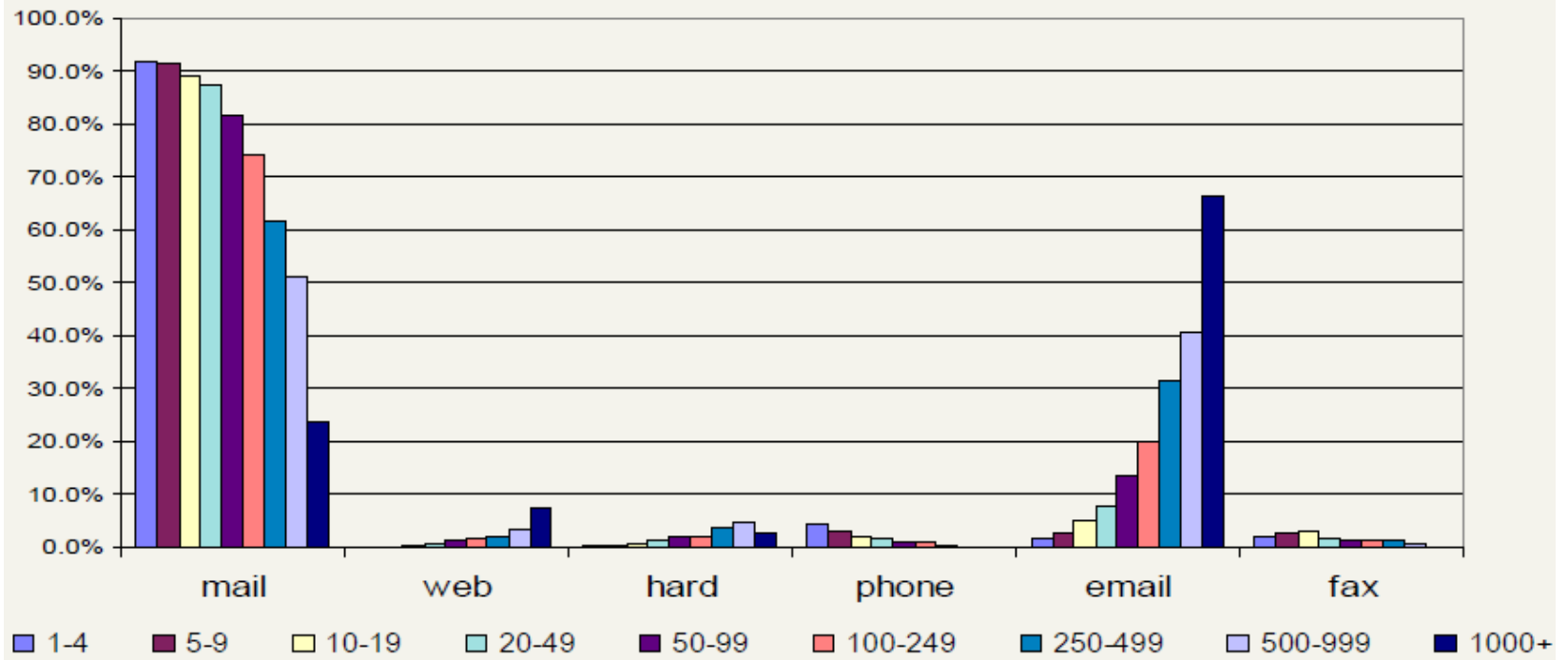
# Occupational Employment Survey (OES)

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- Semi-annual survey measuring occupational employment and wage rates by industry
- Conducted by State employment workforce agencies in cooperation with BLS
- Sample frame comes from UI/QCEW
- Initial solicitation mailing, then 3 follow-up mailings
  - ▶ 97 industry-specific forms for medium and large firms; open-ended form for small firms
  - ▶ Survey packets mailed once a month over 4-month period.
  - ▶ Telephone follow-up for NR; other collection modes (e.g., email, web)

# OES Mode Study

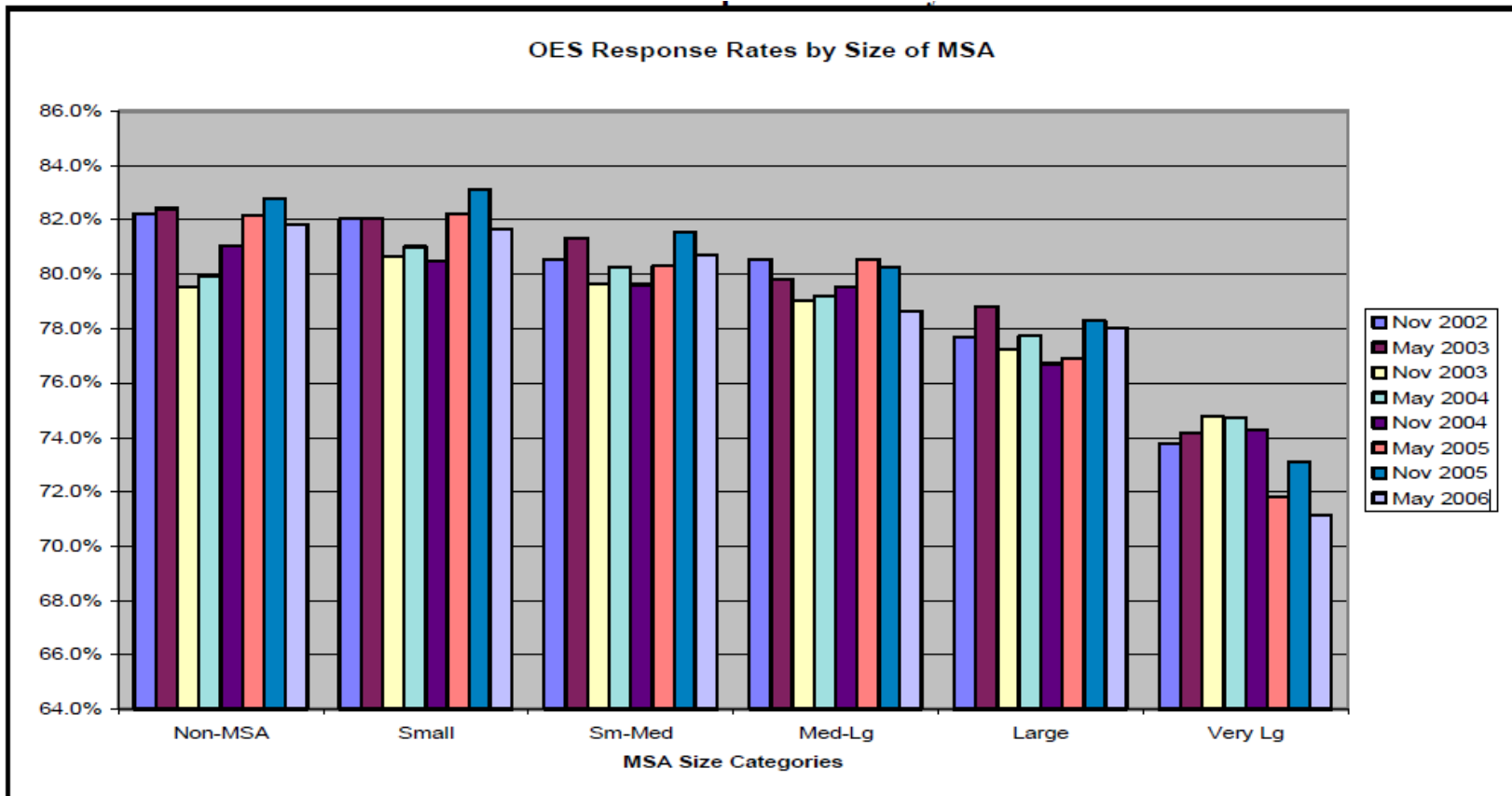
## Collection Mode responses by establishment size (number of employees)



# OES Postcard Test

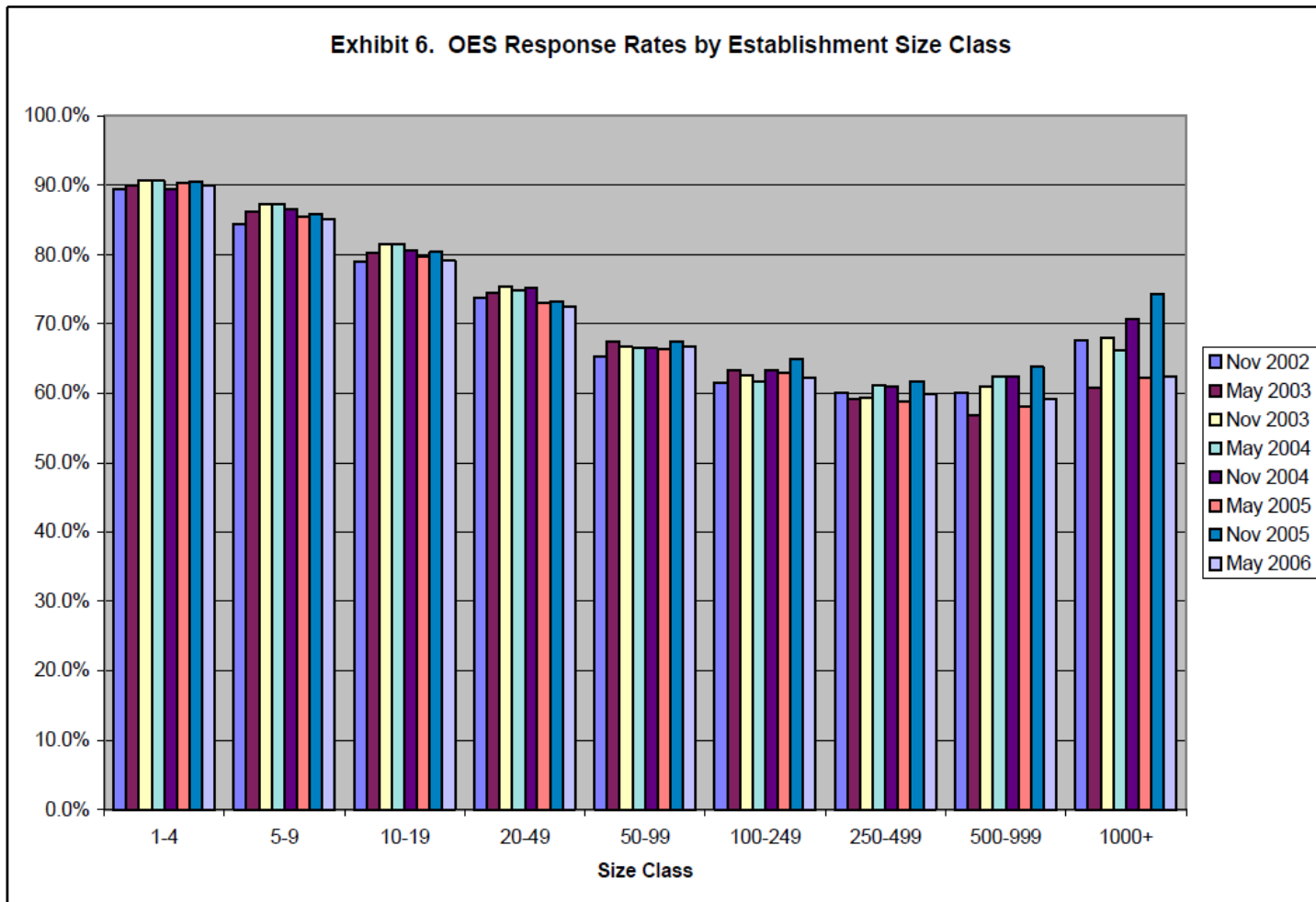
- 2007 – 2009 OES test groups sent reminder postcard at 2<sup>nd</sup> mailing instead of full survey packet (control)
- Goals of test:
  - ▶ Reduce postage costs associated with sending full packet, and number of packets that crossed in the mail after initial mailing
  - ▶ Examine impact on response rates
- Main findings:
  - ▶ Per-unit costs: \$3.26 (test group) vs. \$4.98 (control group)
  - ▶ Projected savings per panel: \$240,000
  - ▶ No negative effect on response rates for small/medium firms
  - ▶ Reduction in response rates for largest units
    - Mixed approach best: postcards for small/medium, full packet for large

# Factors Affecting Response in OES



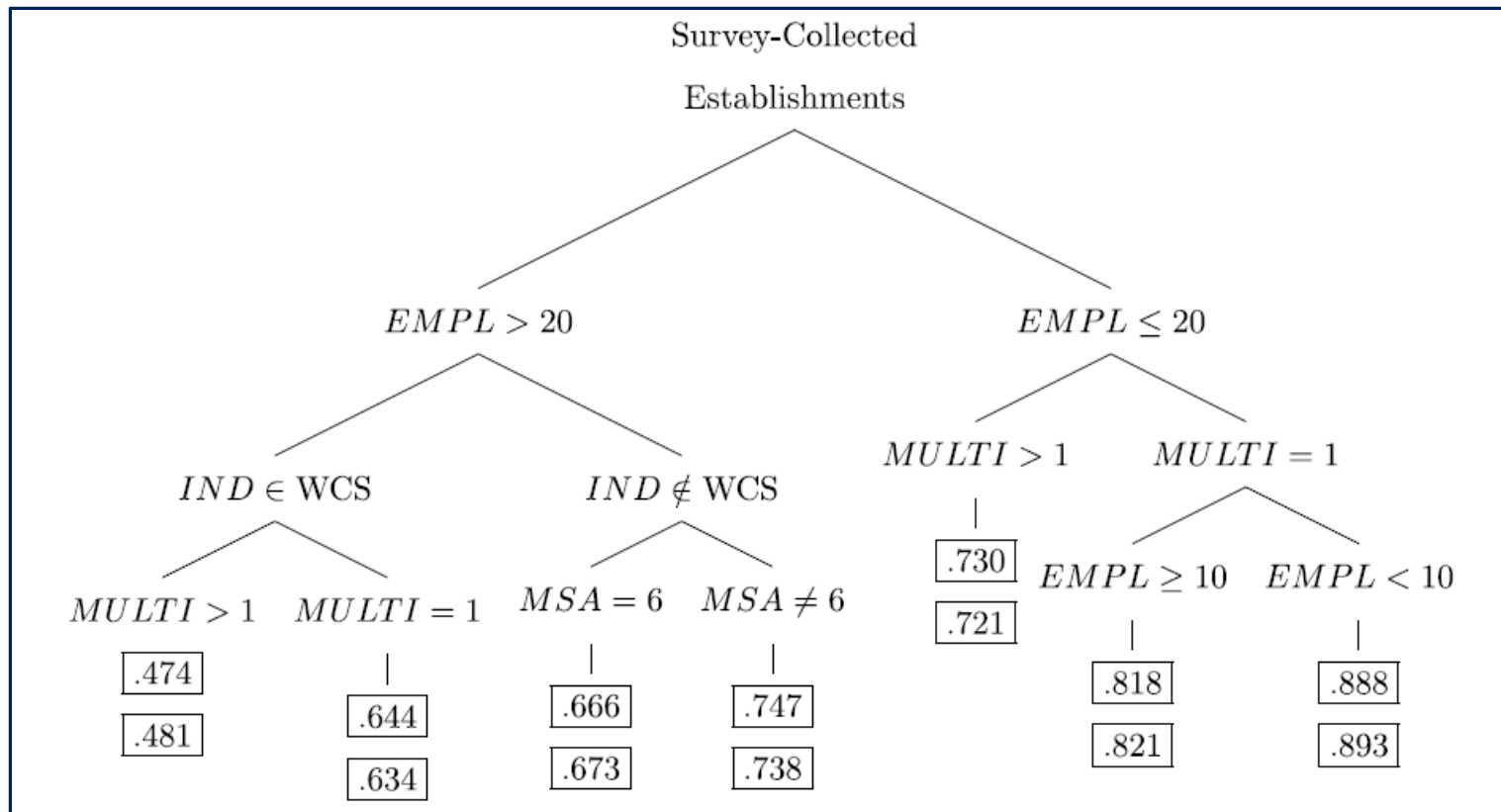
Phipps and Jones (2007)

# Factors Affecting Response in OES, cont.



# Estimating Propensity to Respond in OES

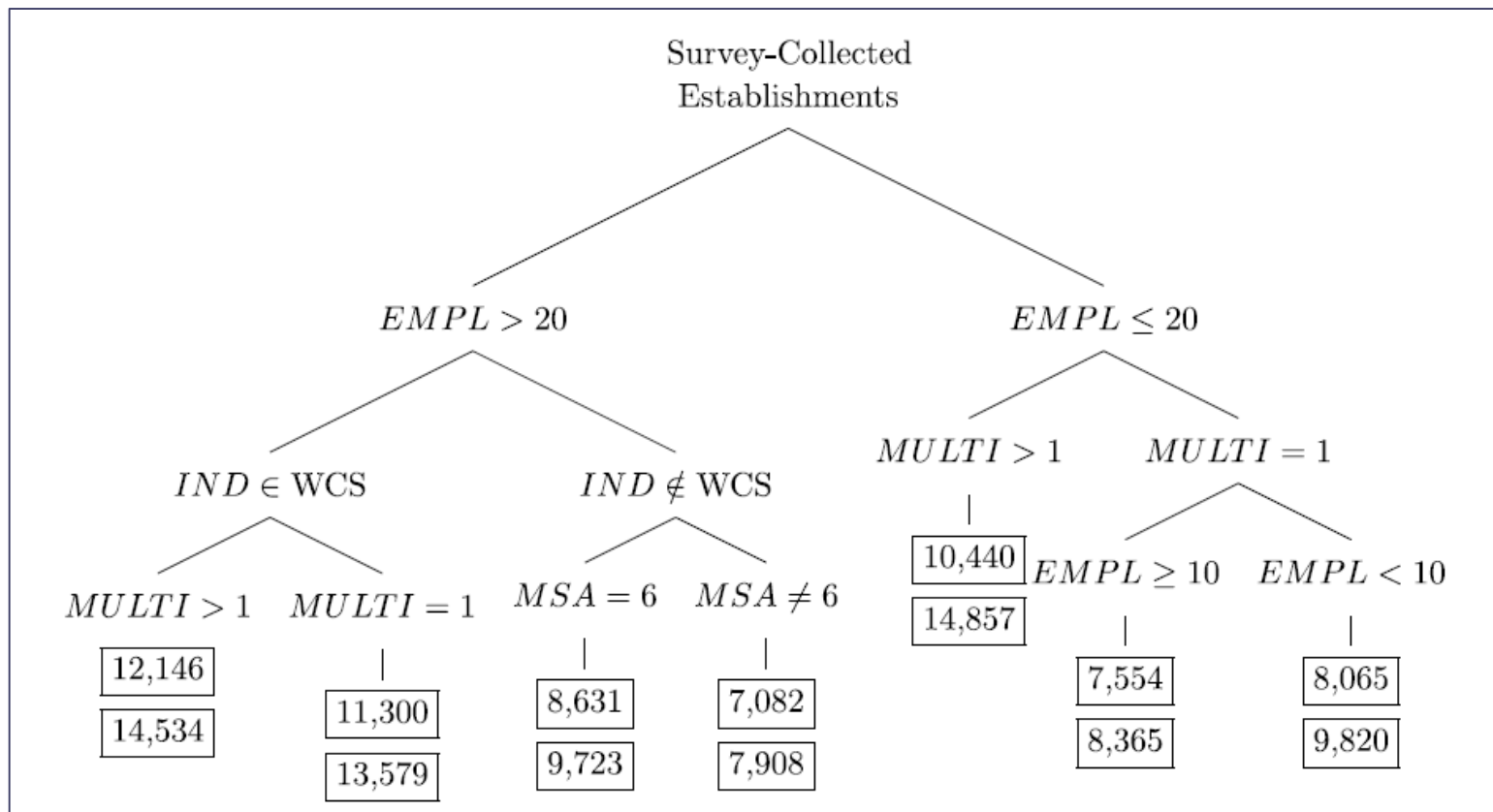
Phipps and Toth (2012)





# How OES Response Propensity Groups Relate to Reported Wages

Phipps and Toth (2012)



# Exploring AD Strategies for the International Price Program

- IPP is a longitudinal survey that collects monthly price data for imports/exports
  - ▶ Sampling frames contain information about industry, size, product category/strata, dollar value of shipped goods
  - ▶ Sample design based on costs and R burden
- Initiation (PV), monthly re-pricing (mail, web, fax)
- Published estimates of price changes may be revised in each of the 3 months after original publication
- Large changes in revisions may indicate poor quality

# IPP Adaptive Design Work

- Exploratory project carried out Westat
- Examined statistical properties of 2011-2012 IPP estimates to link survey quality to design features
- Quality measures: revisions to IPP change estimates
  - ▶ Signal-to-noise ratio: revision amount in strata / SE for revision
  - ▶ Calculated for 1-month and 12-month change estimates, for imports and exports separately
- Proposed *traffic lighting* scheme
  - ▶ Green – precise estimates whose absolute value exceeds threshold
  - ▶ Light green – precise estimates with absolute value below threshold
  - ▶ Yellow – noisy estimates with absolute values less than some threshold
  - ▶ Red – noisy estimates with absolute values above threshold

# IPP Traffic Lighting Example

- Traffic lighting scheme can be used to identify candidate strata for AD strategies, e.g.:
  - ▶ High prevalence of red estimates at 4<sup>th</sup> closing → increase # of final price quotes (e.g., increase sample allocation, lower NR)
  - ▶ Prevalence of red estimates at 1<sup>st</sup> and 2<sup>nd</sup> closings but not 4<sup>th</sup> → decrease # of price quotes

Stratum	2011-09	2011-10	2011-11	2011-12	2012-01	2012-02	2012-03	2012-04	2012-05	2012-06	2012-07
1	●	●	●	●	●	●	●	●	●	●	●
2	●	●	●	●	●	●	●	●	●	●	●
3	●	●	●	●	●	●	●	●	●	●	●
4	●	●	●	●	●	●	●	●	●	●	●
5	●	●	●	●	●	●	●	●	●	●	●
6	●	●	●	●	●	●	●	●	●	●	●

# Questions

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- Given some of the challenges of implementing adaptive designs in BLS establishment surveys (e.g., real-time estimation of key survey statistics; insufficient systems integration; Fed-State programs), which areas should BLS focus efforts? (low-hanging fruit? High ROI?)
- How can BLS best leverage existing cost information, or develop new mechanisms to capture that information? Can we/how can we develop cost measures/structures that are applicable across survey programs?
- Field staff/managers have expressed concerns about collecting additional paradata – additional burden, potential use in evaluations, labor-management issues, etc. And, in general, moving to more adaptive approaches is a cultural shift for the entire organization. How can we push development of new measures of “success” that are acceptable to field staff, OMB, etc., create buy-in?

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