



USE OF CENSUS PUMS BY STATE DEPARTMENTS OF TRANSPORTATION AND METROPOLITAN PLANNING ORGANIZATIONS

APPLYING CENSUS DATA FOR TRANSPORTATION TRB CONFERENCE

KANSAS CITY, MISSOURI

NOVEMBER 14 – NOVEMBER 16, 2017

KEVIN TIERNEY

BIRD'S HILL RESEARCH



OVERVIEW OF PUMS USAGE BY TRANSPORTATION PLANNERS

Today's Discussion

- Very Brief Overview of The Census Public Use Microdata Sample (PUMS)
- Findings of the Synthesis of Practice
 - User and Non-User Perspectives
 - Types of PUMS Analyses



OVERVIEW OF PUMS



NATURE OF PUMS DATA

ACS Data Files

- Summary tables of collected ACS data designed by analysts
- Basic, most-commonly needed variable tabulations available at detailed geographic delineations
- Fixed content and time-frame
- CTPP provides extended summary tables

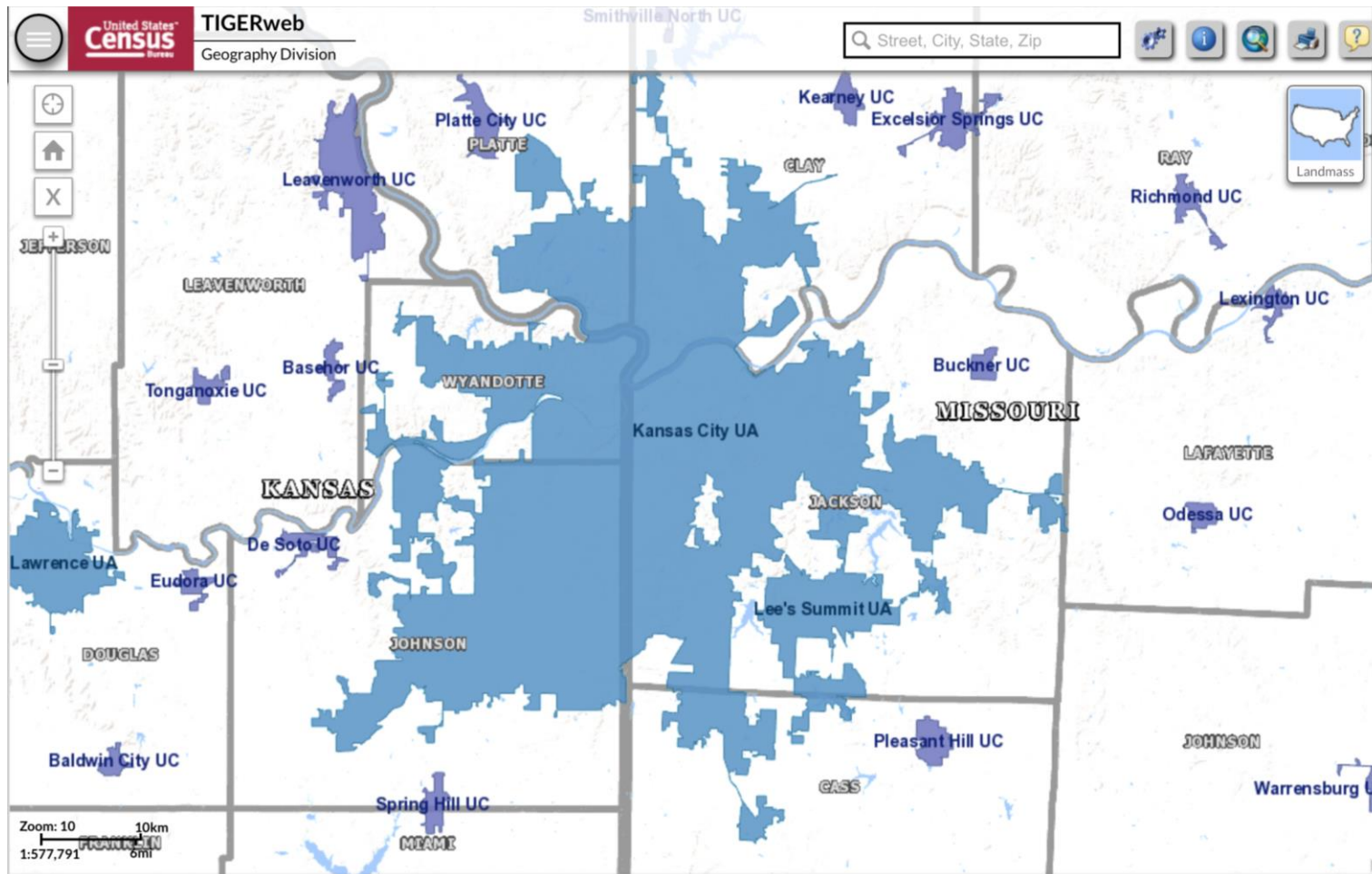
ACS PUMS Microdata

- Sample of ACS household and person data records
- Enables users to develop custom tabulations and analyses
- More difficult to use - Requires users to process files
- Larger geographic delineation only

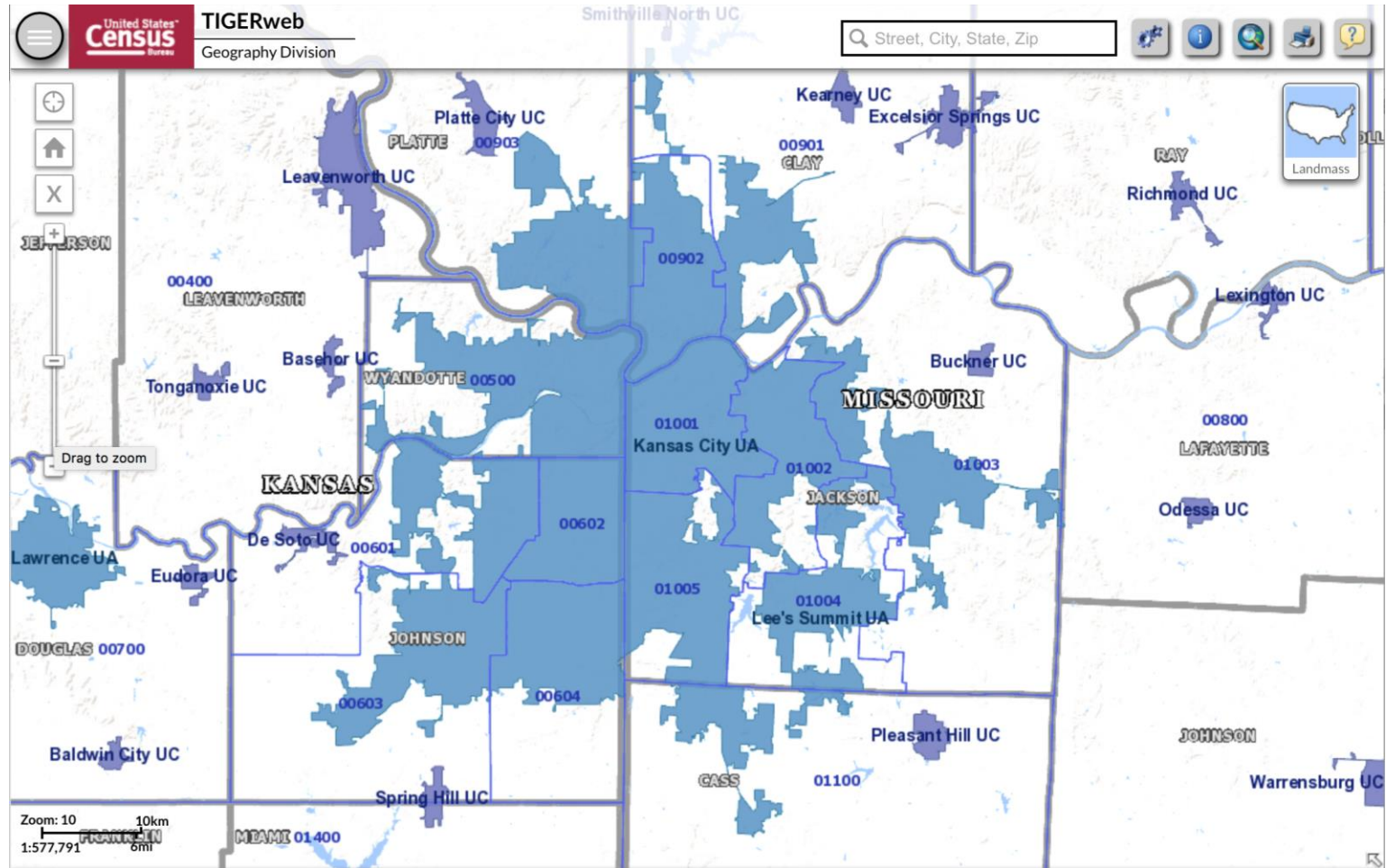
PUMS PRECISION AND ACCURACY

- Sample of ACS records
 - (About 2/3rds of data records)
 - Reduced precision / larger margins-of-error
- PUMS specific edits to maintain confidentiality
 - Re-weighting
 - New top- and bottom-coding
 - Data swapping
- Restricted to PUMA geographic delineation
 - Contiguous areas with populations of more than 100,000, nested within states, built up from county and tract definitions
 - Defined by the Census Bureau and State Data Centers
 - University of Missouri's MABLE/Geocorr provides geographic correspondences

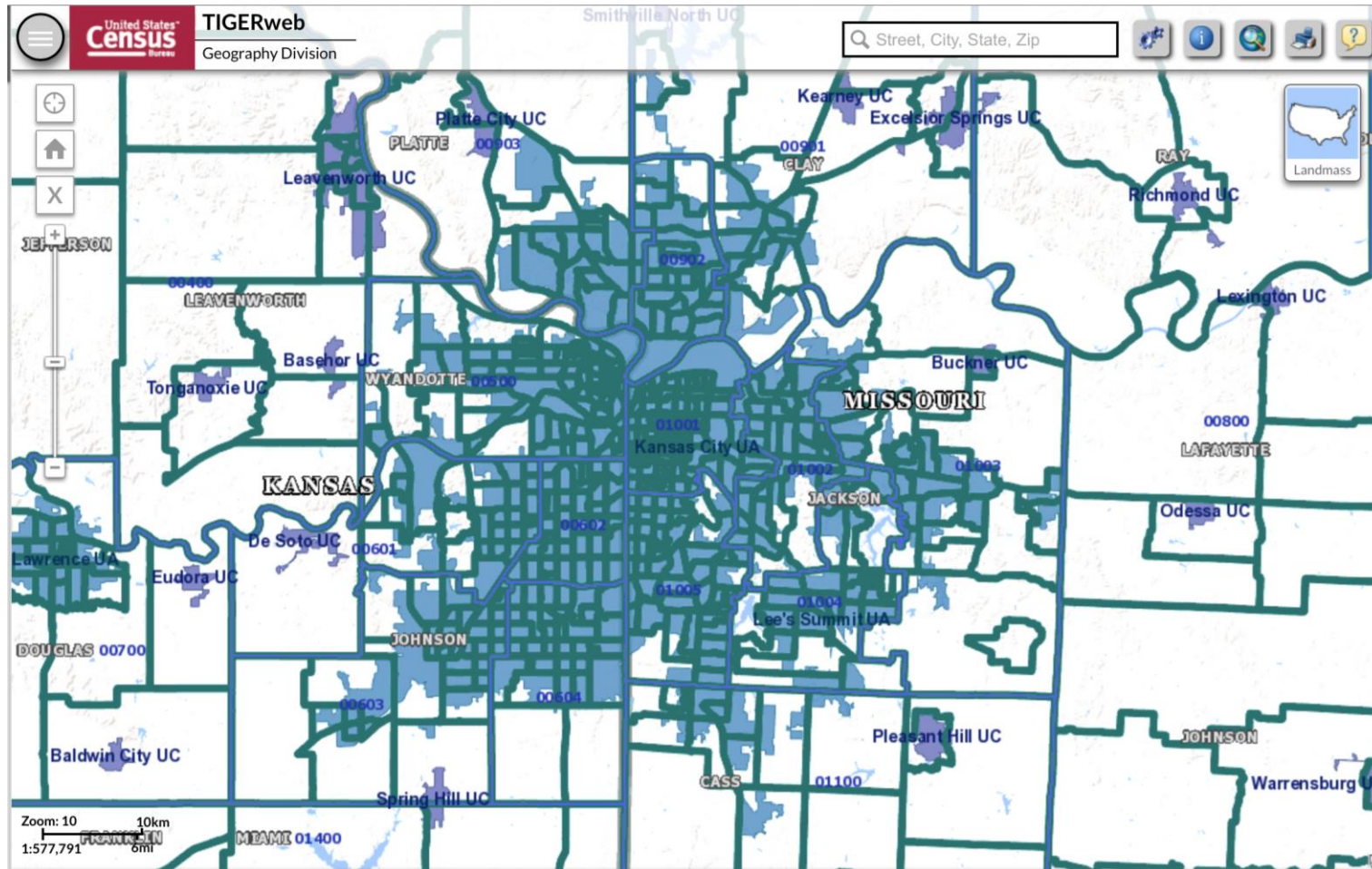
CENSUS PUMA GEOGRAPHY



CENSUS PUMA GEOGRAPHY



CENSUS PUMA GEOGRAPHY



OBTAINING PUMS DATA

- Census Bureau 1-Year and 5-Year CSV and SAS Files
 - ACS Website
 - American Fact Finder
 - DataFerrett
 - FTP
- IPUMS

The screenshot shows the 'American Community Survey (ACS)' PUMS Data page. The page is titled 'American Community Survey (ACS)' and 'PUMS Data'. It features a navigation menu with categories like 'Topics', 'Geography', 'Library', 'Data', 'Surveys/Programs', 'Newsroom', and 'About Us'. The main content area is divided into several sections:

- About the Survey**: Includes links for 'Respond to the Survey', 'News & Updates', and 'Data'.
- PUMS Data**: A section with social media sharing options (Tweet, Share) and a note: 'Supporting documentation for the data below is available on the PUMS Documentation page.'
- PUMS Data 2005 - Current**: A list of available data years and periods:
 - 2016 ACS 1-year PUMS
 - 2011-2015 ACS 5-year PUMS
 - 2015 ACS 1-year PUMS
 - 2010-2014 ACS 5-year PUMS
 - 2014 ACS 1-year PUMS
 - 2009-2013 ACS 5-year PUMS
 - 2011-2013 ACS 3-year PUMS
 - 2013 ACS 1-year PUMS
 - 2008-2012 ACS 5-year PUMS
 - 2010-2012 ACS 3-year PUMS
 - 2012 ACS 1-year PUMS
 - 2007-2011 ACS 5-year PUMS
 - 2009-2011 ACS 3-year PUMS
 - 2011 ACS 1-year PUMS
 - 2006-2010 ACS 5-year PUMS
- Available through the FTP site**: A list of years:
 - 2004 ACS PUMS
 - 2003 ACS PUMS
 - 2002 ACS PUMS
 - 2001 ACS PUMS
 - 2000 ACS PUMS
- 1996-98 PUMS Files Available on DVD**: A note stating 'Microdata for select test areas is available on DVD.' and a bullet point: 'To request a DVD, email your name and mailing address and specify dataset (PUMS 1996-1998) to acso.dvd.order@census.gov. You may be contacted for additional information before your request is filled.'
- Related Information**: Includes a 'Tell Us What You Think!' link, a link to 'Introduction to the Public Use Microdata Sample (PUMS) File February 2017', and a link to 'What Public Use Microdata Sample Data Users Need to Know February 2009'.

CENSUS PUMS DOCUMENTATION

The screenshot shows the Census Bureau website's navigation menu with categories like 'Topic', 'Geography', 'Library', 'Data', 'Surveys/Programs', 'Newsroom', and 'About Us'. The main content area is titled 'American Community Survey (ACS)' and 'Public Use Microdata Sample (PUMS) Documentation'. It includes a sidebar with 'Technical Documentation' and 'PUMS Documentation' sections. The main text explains that PUMS files are untabulated records of individual people or housing units, and provides information on confidentiality, why to use PUMS, and how to access them. A 'Safari MS Technical Documentation' link is also visible.

The slide features a title in red text: 'American Community Survey (ACS) Introduction to the American Community Survey Public Use Microdata Sample (PUMS) Files'. Below the title, the date 'February 22, 2017' and the presenter's name 'Javier Gomez' are listed. The presenter's affiliation, 'American Community Survey Office', is shown at the bottom. The slide includes the United States Census Bureau logo and the U.S. Department of Commerce, Economics and Statistics Administration logo. A page number '1' is located in the bottom right corner.

<https://www.census.gov/programs-surveys/acs/data/pums.html>



PUMS USAGE SYNTHESIS PROJECT



USAGE OF PUMS DATA BY TRANSPORTATION PLANNERS

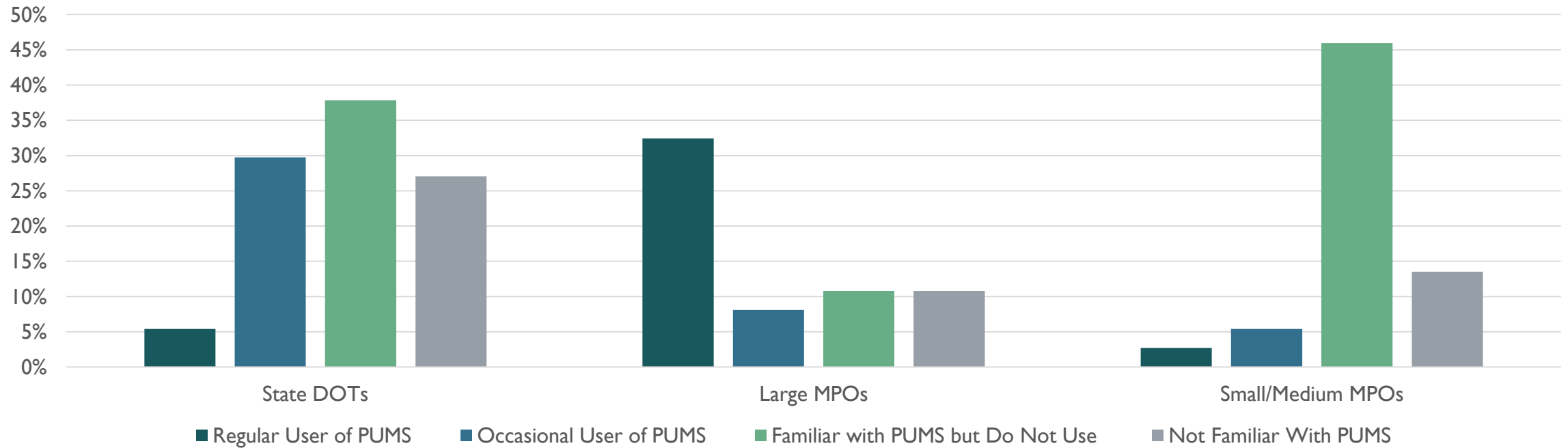
- Synthesis of practice describing how transportation planners use PUMS data
 - Review of published and unpublished documentation on PUMS usage by transportation planners
 - In-depth interviews with transportation planners that use PUMS data
 - Web-based survey scan of Census data users within transportation agencies
- NCHRP Synthesis 434

WEB-BASED SURVEY SAMPLE AND RESPONSE

Agency Type	Total Agencies	Sample Agencies	Completed Surveys	Response Rate
State DOTs	52	52	37	71%
Large MPOs	42	42	23	55%
Small/Medium MPOs	339	75	25	33%
Total	433	169	85	50%

USAGE OF CENSUS PUMS DATA BY TRANSPORTATION PLANNING AGENCIES

Agency Usage of PUMS Data



PUMS DATA USAGE BY AGENCY TYPE

	State DOTs	Larger MPOs	Smaller MPOs	Academic Researchers
Travel Demand Modeling	●●●	●●●	●●	●
Travel Surveys	●●●	●●●	●	●
Synthetic Population Microsimulation	●●	●●●	●	●●●
Custom Tabulations	●	●●	●	●●●

MOST COMMON REASONS FOR NOT USING PUMS DATA

- Agencies asked if the following reasons applied (Multiple choices):
 - Not completely aware of what the PUMS data are - (44% of agencies)
 - No need for PUMS given availability of other data sources – (48% of agencies)
 - Lack technical knowledge and/or time needed to use PUMS – (22% of agencies)
 - Not satisfied with PUMS geographic area sizes – (7% of agencies)
 - Software and computing limitations - (0% of agencies)
 - Not satisfied with PUMS data quality and consistency – (0% of agencies)
 - Not satisfied with PUMS weighting and sampling – (0% of agencies)
 - Not satisfied with PUMS workplace location / commuting – (0% of agencies)

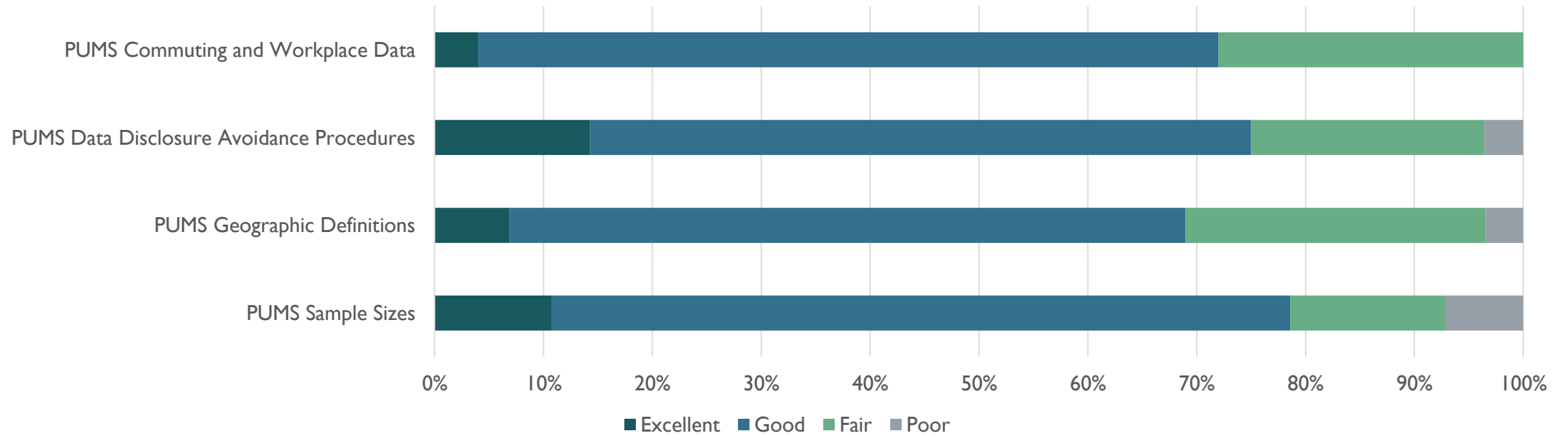
DATA USERS' RATINGS OF PUMS CHARACTERISTICS

PUMS Data User Ratings



DATA USERS' RATINGS OF PUMS CHARACTERISTICS

PUMS Data User Ratings



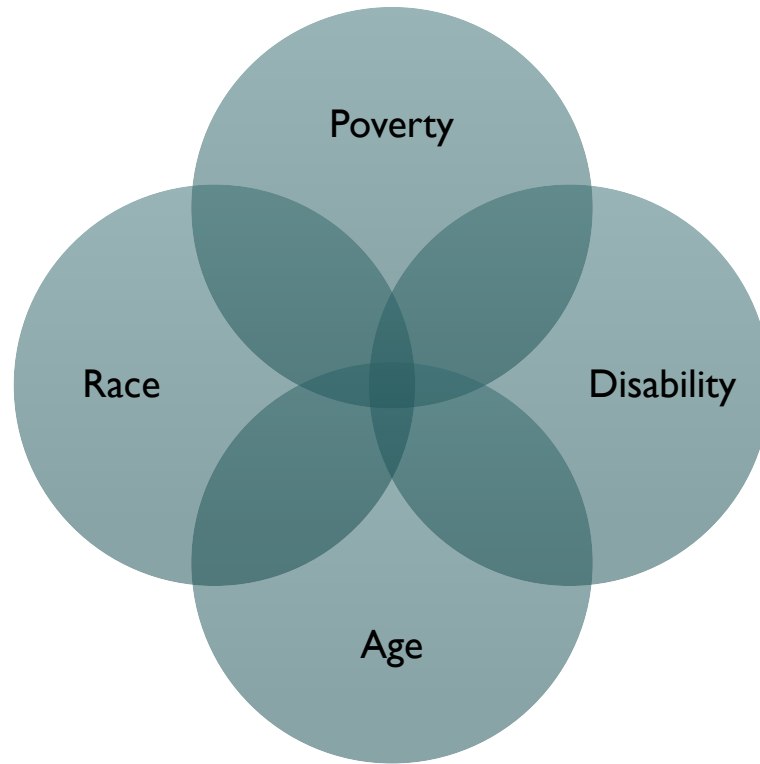


TYPES OF TRANSPORTATION PLANNING ANALYSES BEING CONDUCTED WITH PUMS DATA



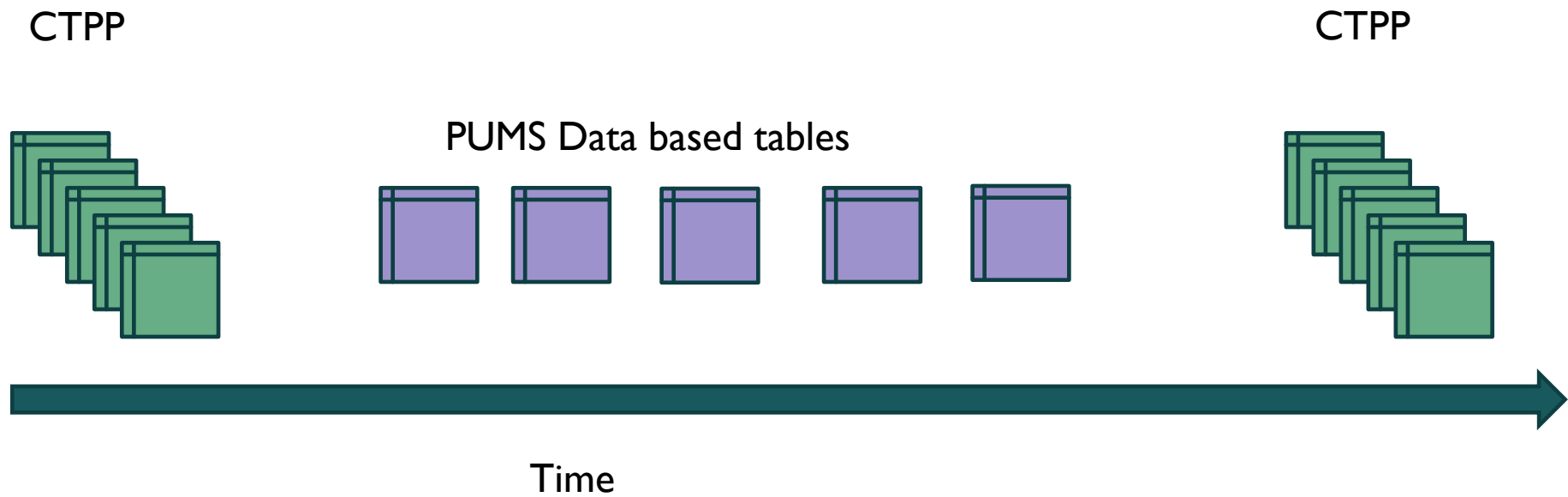
CROSS-TABULATIONS OF CENSUS VARIABLES

Tabulations Not Readily Available From ACS Tables Or CTPP



CROSS-TABULATIONS OF CENSUS VARIABLES

Tabulations With More Frequency Than CTPP



DISAGGREGATE STATISTICAL ANALYSES

- Regression Models

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_\rho X_\rho + \epsilon$$

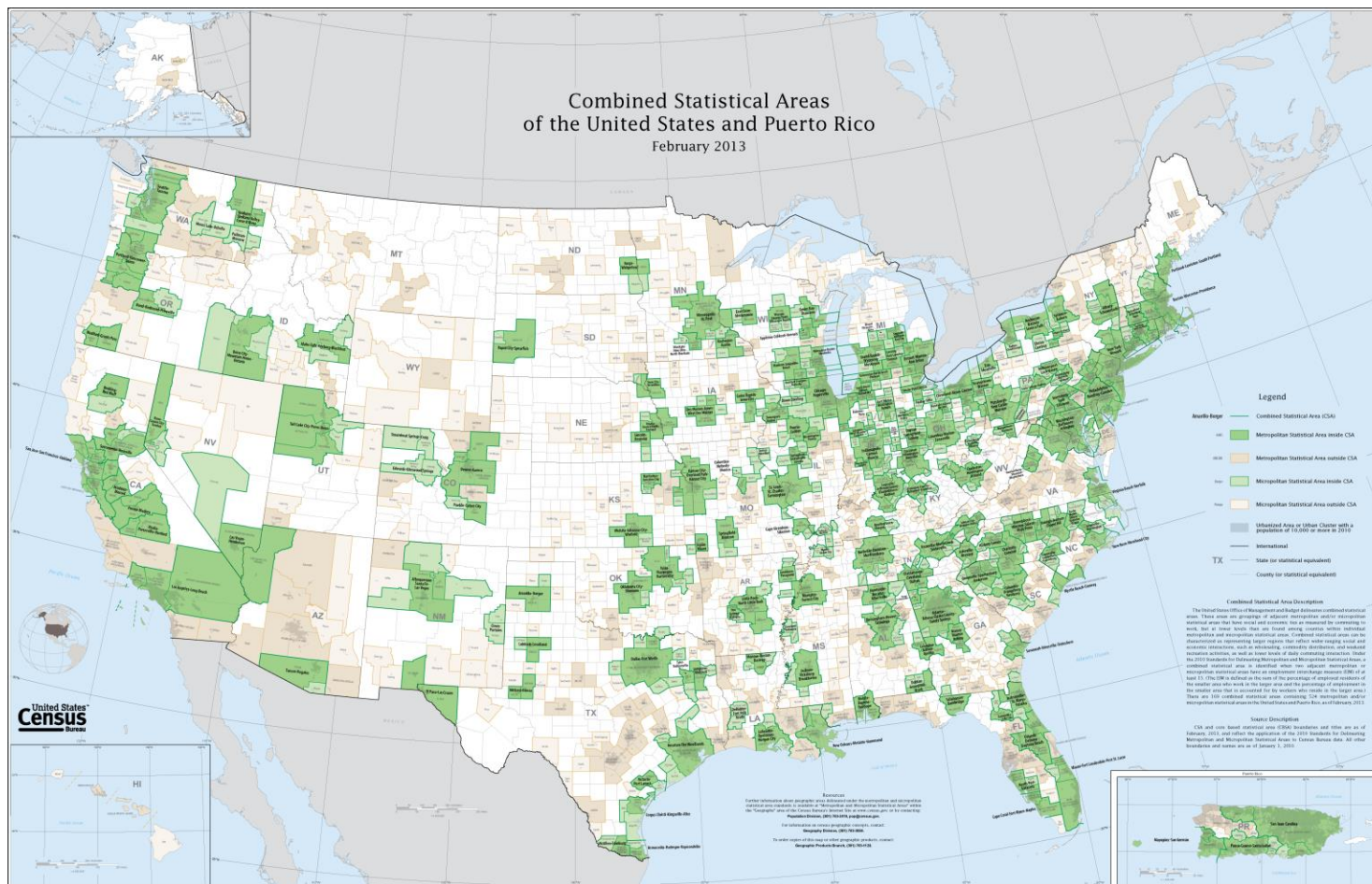
- Correlation Analyses

$$r = \frac{s_{xy}}{s_x s_y} = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}}$$

- Discrete Choice Models

$$P(Y_{ij} = j) = \frac{e^{(\beta_j X_i)}}{1 + \sum_{k=1}^J e^{(\beta_k X_i)}}$$

COMPARISONS OF DIFFERENT REGIONS



COMPARISONS OVER TIME

Median Wage for Workers
by Place of Residence and Work
(1990-2013)

Public Use Microdata Sample (PUMS)

2013

Place of Residence	2013 Place of Work						
	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	\$28,154	\$2,637	\$43,744	\$18,983	\$4,218	\$108,547	\$43,455
Los Angeles	\$40,995	\$27,990	\$36,896	\$35,284	\$30,747	\$37,991	\$30,226
Orange	\$163,982	\$55,344	\$31,973	\$48,121	\$45,340	\$40,302	\$53,188
Riverside	\$40,909	\$48,444	\$46,120	\$24,597	\$38,946	\$25,189	\$47,458
San Bernardino	\$32,904	\$43,419	\$43,419	\$33,048	\$25,837	\$32,296	\$37,996
Ventura	-	\$60,453	\$58,438	\$4,091	\$52,731	\$27,420	\$65,669
San Diego	\$77,511	\$54,273	\$60,113	\$53,188	\$42,185	\$70,528	\$32,564

(Source: 2013-14 ACS 5-year PUMS (CPI adjusted to \$ in 2012))

2008

Place of Residence	2008 Place of Work						
	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	\$20,804	\$27,581	\$28,369	\$25,217	\$23,641	\$30,576	\$27,581
Los Angeles	\$40,978	\$23,641	\$26,005	-	\$37,826	\$40,978	\$35,482
Orange	\$39,402	\$33,097	\$19,701	\$37,826	\$18,369	\$47,282	\$31,521
Riverside	\$22,065	\$26,793	\$23,641	\$16,549	\$33,097	-	\$27,581
San Bernardino	\$31,521	\$31,521	\$23,641	\$86,684	\$19,701	\$45,706	\$23,641
Ventura	\$44,918	\$56,738	\$10,560	-	\$60,679	\$23,641	\$20,489
San Diego	\$43,342	\$39,402	\$37,826	\$55,162	\$63,043	\$17,337	\$25,217

(Source: 2008 ACS PUMS (CPI adjusted to \$ in 1999))

2000

Place of Residence	2000 Place of Work						
	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	\$19,000	\$16,000	\$6,300	\$10,400	\$8,1000	-	\$25,200
Los Angeles	\$20,000	\$21,000	\$27,900	\$26,800	\$22,400	\$28,000	\$21,000
Orange	\$10,500	\$41,000	\$24,600	\$30,000	\$40,000	\$35,000	\$39,000
Riverside	\$44,400	\$40,000	\$36,500	\$18,000	\$30,000	\$40,000	\$36,800
San Bernardino	\$27,800	\$35,000	\$35,000	\$27,000	\$19,500	\$42,000	\$26,000
Ventura	-	\$43,000	\$45,000	\$50,000	\$40,000	\$22,000	\$45,000
San Diego	\$30,000	\$36,000	\$40,000	\$30,000	\$19,000	\$35,000	\$23,600

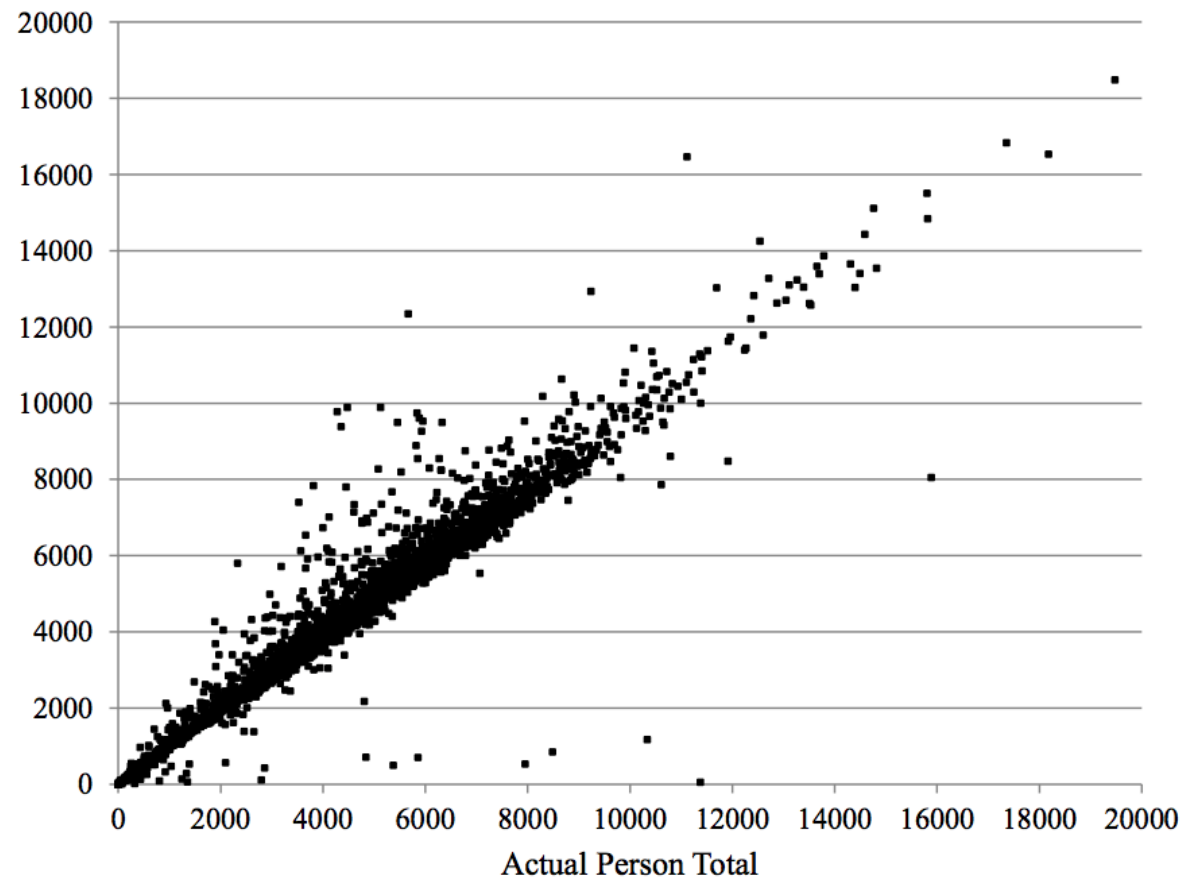
(Source: 2000 PUMS (CPI adjusted to \$ in 1999))

1990

Place of Residence	1990 Place of Work						
	Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	\$16,830	\$6,991	\$32,365	\$16,364	\$41,427	\$7,664	\$23,303
Los Angeles	\$23,303	\$22,008	\$27,758	\$25,892	\$22,008	\$29,776	\$16,535
Orange	\$23,303	\$42,722	\$23,303	\$32,365	\$33,660	\$38,838	\$36,838
Riverside	\$12,946	\$41,427	\$37,543	\$17,865	\$31,070	\$36,249	\$31,718
San Bernardino	\$5,1784	\$36,016	\$36,249	\$27,187	\$19,419	\$46,608	\$32,365
Ventura	-	\$44,016	\$49,345	\$36,191	\$25,692	\$20,774	\$28,481
San Diego	\$29,776	\$37,543	\$36,249	\$27,187	\$29,776	\$33,660	\$20,774

(Source: 1990 PUMS (CPI adjusted to \$ in 1999))

VALIDATION OF OTHER DATA SOURCES



PUMS DATA FOR CUSTOM CROSS-TABULATIONS AND SUMMARIES

- Transportation Profiles
- Research on Gender and Transportation
- Research on Immigration and Transportation
- Analyses of Jobs Access
- Analyses of Land Use Policies

PUMS DATA TO SUPPORT TRAVEL SURVEYS

- Sample Planning
- Survey Weighting
- Survey Validation

PUMS DATA TO SUPPORT TRAVEL DEMAND MODELING

- Traditional Travel Model Calibration
 - Household Characteristics Model Development
 - Vehicle Availability Model Development
 - Internal-External Model Development
- Support Specialized Demand Modeling Applications
 - Land-use & Residential Choice Modeling
 - Vehicle Emissions Modeling
 - Travel Market Segmentation Modeling
- Support Population Microsimulation
 - Activity Based Models
 - Integrated Land Use Models
 - Travel Data Simulation

QUESTIONS?

