Calculating Statistical Significance and Margins of Error Using American Community Survey Data

Maryland State Data Center Affiliate Meeting

September 16, 2010

OR …

MAKING IT EASY!

ACS Sample Size for Maryland's Housing Units

Year	Sample Size	Housing Unit Estimate	Percent
2006	32,435	2,299,774	1.37%
2007	31,886	2,318,513	1.38%
2008	31,915	2,332,421	1.41%
Total (2006-2008)			4.15%

Sample Size for Decennial Long-Form was 16.7% (1 out of 6 Housing units)

Sampling Error & Standard Error

- **Sampling error** occurs when estimates are derived from a sample rather than a census (complete count) of the population.

- **Standard error** is an estimate of sampling error – how precise the survey estimates are to the true population you are trying to measure

Sampling Error & Margin of Error

- **Margin of Error** = standard error for a given confidence interval (typically 90 percent). A measure of the precision of the estimate at a given confidence interval

- Sampling error in the ACS is reported as the estimate “plus or minus” the margin of error

Margin of Error (MOE)

- MOE = 1.645 * Standard error

  where 1.645 is used for the 90 pct confidence interval

- Use the MOE to construct the Lower and Upper bounds around the estimate

- Lower Bound = (estimate – MOE)
- Upper Bound = (estimate + MOE)

Baltimore City Median Household Income Estimate from the 2008 ACS

B19013. MEDIAN HOUSEHOLD INCOME IN THE PAST 12 MONTHS (IN 2008 INFLATION-ADJUSTED DOLLARS) - Universe: HOUSEHOLDS
Data Set: 2008 American Community Survey 1-Year Estimates
Survey: American Community Survey

NOTE. Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, cou estimates of housing units for states and counties.

For information on confidentiality protection, sampling error, nonsampling error, and definitions, see Survey Methodology.

	Baltimore city, Maryland	
	Estimate	Margin of Error
Median household income in the past 12 months (in 2008 inflation-adjusted dollars)	40,313	+/-1,482

Source: U.S. Census Bureau, 2008 American Community Survey

90 % C.I. = $40,313 +/- $1,482
= $38,831 to $41,795

90 Percent Confidence Interval

- Odds are 9 to 1 that the interval contains the “true” value that you would have gotten from a full census

Why you should care about Margins of Error

- Lets you know how good the data is
- Saves you from drawing erroneous conclusions.
- Helps you decide how confident you can be about the assertions you make

First Example: Comparing Two Estimates

- If have two estimates, need to determine if the apparent differences are “real” (i.e. are statistically significant)
- Quick and dirty method is to “eye ball” whether the confidence intervals of the two estimates overlap

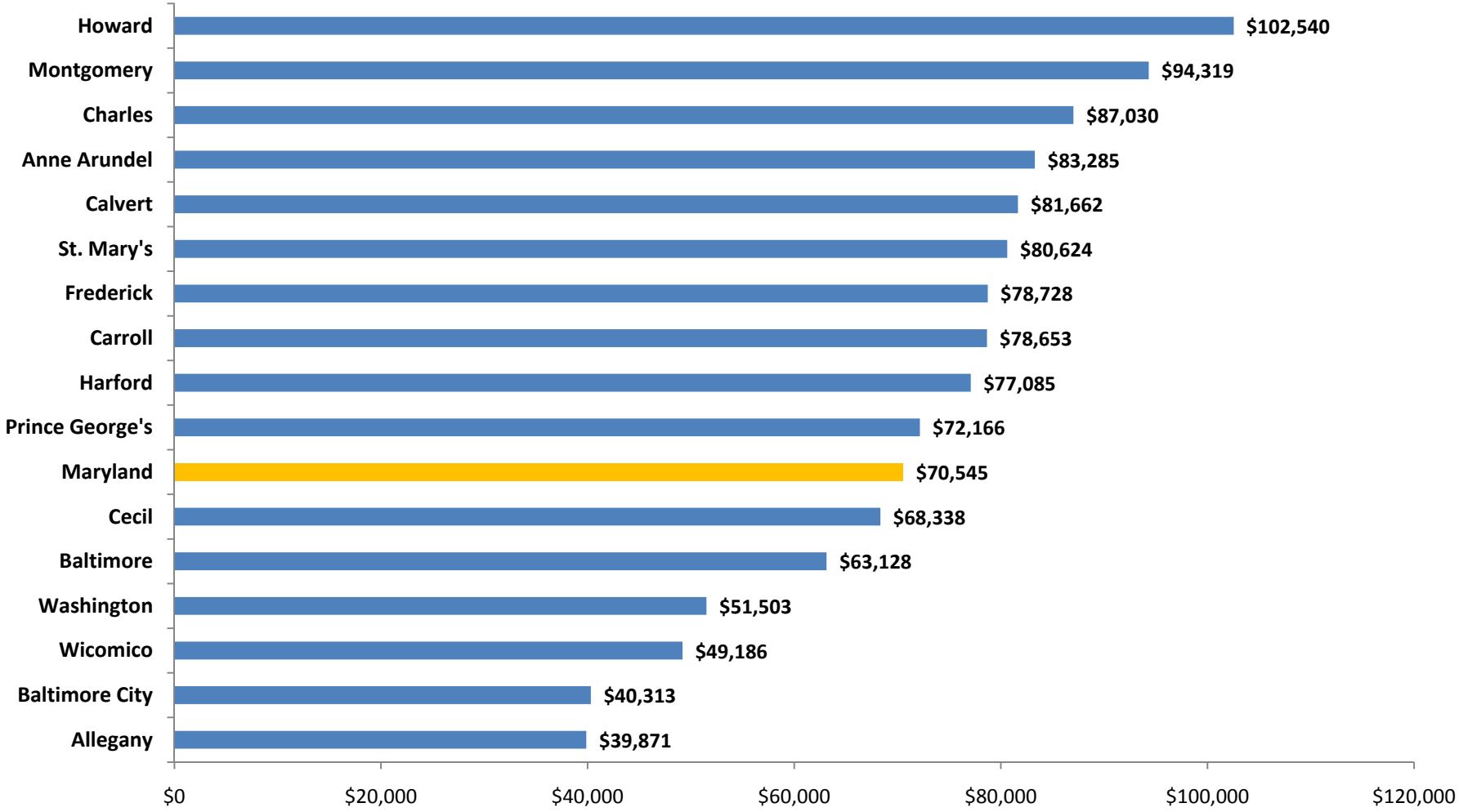
Comparing Two Estimates (the easy way)

- If the confidence intervals of two estimates do ***not*** overlap, then the difference between the two estimates are statistically significant

- If the confidence intervals of two estimates do overlap, then the difference between the two estimates may or may not be statistically significant (will need to test)

Estimates

Median Household Income in Maryland and its Jurisdictions, 2008 (In 2008 Inflation-Adjusted Dollars) *

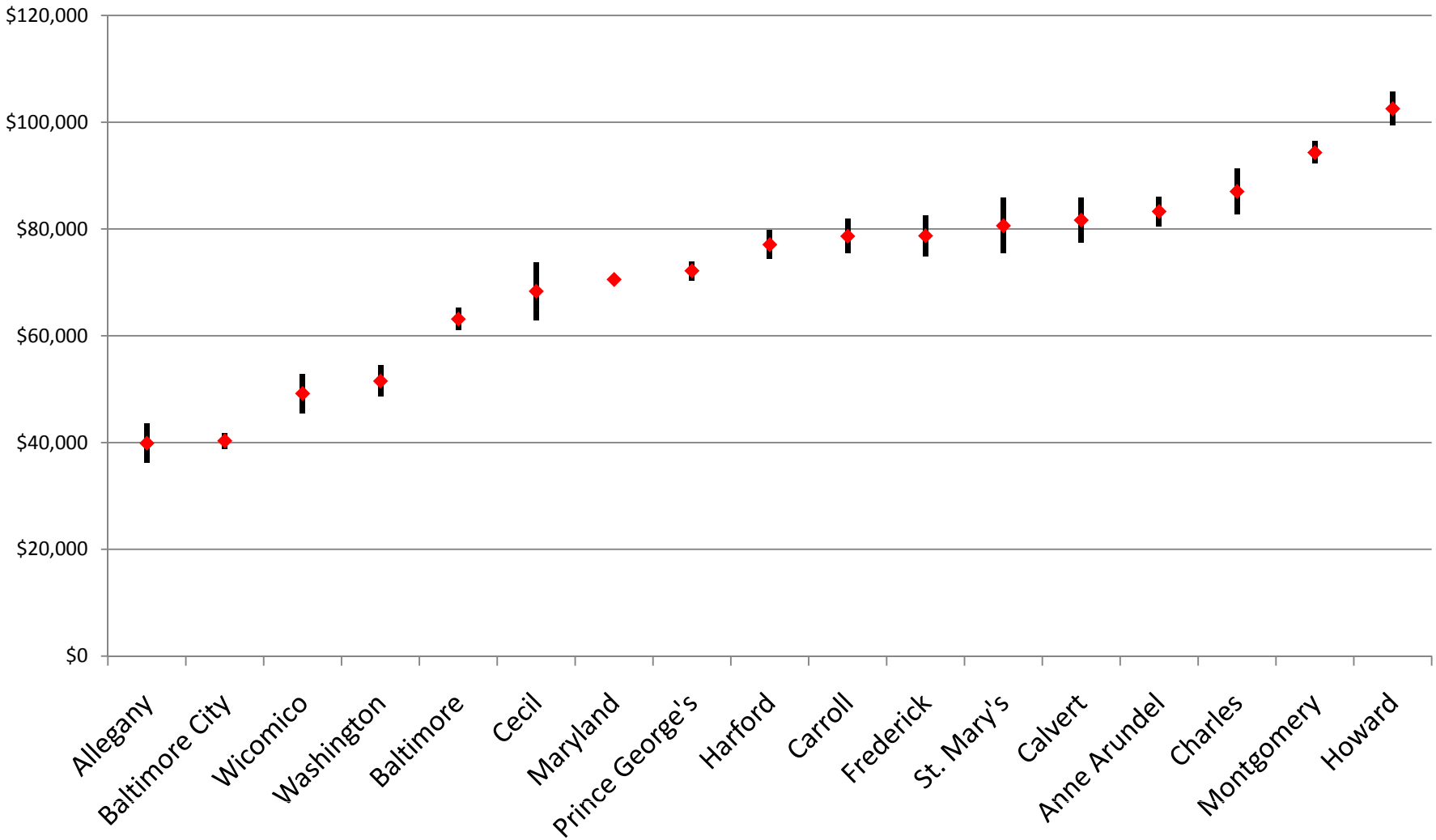


* Apparent differences may not be statistically significant at the 90 percent confidence interval.

Prepared by the Maryland Department of Planning, from the 2008 ACS for the 16 counties covered (population of 65,000 or more), September 2009

Estimates with Confidence Intervals

Median Household Income in Maryland and its Jurisdictions, 2008
(In 2008 Inflation-Adjusted Dollars) *



* Apparent differences may not be statistically significant at the 90 percent confidence interval.

Prepared by the Maryland Department of Planning, from the 2008 ACS for the 16 counties covered (population of 65,000 or more), September 2009

2008 Median Household Income Estimates for Allegany County and Baltimore City

	Median Estimate	MOE	Lower Bound	Upper Bound
Allegany County	$39,871	$3,668	$36,203	$43,539
Baltimore City	$40,313	$1,482	$38,831	$41,795

Comparing Two Estimates

- Need to do a formal test of statistical significance if the confidence intervals do overlap

Testing Statistical Significance

1. Absolute value of Difference = ABS(X –Y)
2. SE(x) = MOEx/1.645
3. SE(y) = MOEy/1.645
4. SE(x-y) = $\sqrt{[SE(X)]^2 + [SE(Y)]^2}$
5. MOE (x-y) = SE (x-y)*1.645
6. ABS(X-Y) <> MOE (x-y)

Testing Statistical Significance

1. If ABS(X-Y) > MOE(x-y), then the difference between the two estimates are statistically significant

2. If ABS(X-Y) < MOE (x-y), then the difference between the two estimates are NOT statistically significant

Go to Statistical Calculations Excel File! (significance test worksheet)

Thank you Dr. Lenny Gaines,

New York State Data Center

Testing A Difference Over Time

Anne Arundel County - Percent in Poverty, 2008 and 2007 from the ACS					
	2008 Estimate	Margin of Error (+ /-)	2007 Estimate	Margin of Error (+ /-)	Change
All people	4.1	0.9	4.7	0.8	-0.6
Under 18 years	5.9	2.4	5.1	1.8	0.8
Related children under 18 years	5.5	2.4	4.5	1.9	1.0
Related children under 5 years	7.7	4.1	4.1	2.2	3.6
Related children 5 to 17 years	4.7	2.4	4.6	2.1	0.1
18 years and over	3.5	0.6	4.6	0.7	-1.1
18 to 64 years	3.3	0.6	4.3	0.7	-1.0
65 years and over	**4.3**	**1.5**	**5.9**	**1.5**	**-1.6**
People in families	2.9	1.1	2.7	0.9	0.2
Unrelated individuals 15 years and over	10.6	1.8	14.8	2.1	-4.2

Go to Statistical Calculations Excel File! (significance test worksheet)

Second Example – Calculate MOE of the sum of two or more estimates

Universe: POPULATION FOR WHOM POVERTY STATUS IS DETERMINED		
Data Set: 2008 American Community Survey 1-Year Estimates		
	Carroll County, Maryland	
	Estimate	**Margin of Error (+/-)**
Total:	163,912	2,914
Under .50	5,444	2,195
.50 to .99	6,127	2,226
1.00 to 1.24	1,969	952
1.25 to 1.49	4,361	2,013
1.50 to 1.84	6,885	2,448
1.85 to 1.99	3,150	1,607
2.00 and over	135,976	5,488
Want:		
	Estimate	**Margin of Error (+/-)**
Total	163,912	2,914
Under 1.00	11,571	
1.00-1.99	16,365	
2.00 and over	135,976	5,488

Second Example – Margin of Error of a Sum

1. Calculate the standard error of the sum:

SE ($x_1+x_2+x_3$)=

$$= \sqrt{[MOE(x_1)/1.645]^2 + [MOE(x_2)/1.645]^2 + [MOE_{x3}/1.645]^2}$$

2. Calculate the Margin of error of the sum:

$$MOE(x_1+x_2+x_3) = SE(x_1+x_2+x_3)*1.645$$

Go to Statistical Calculations Excel File! (StdErrSum3ormore)

Second Example – Calculate MOE of the sum of two or more estimates

C17002. RATIO OF INCOME TO POVERTY LEVEL IN THE PAST 12 MONTHS -		
Universe: POPULATION FOR WHOM POVERTY STATUS IS DETERMINED		
Data Set: 2008 American Community Survey 1-Year Estimates		
	Carroll County, Maryland	
	Estimate	**Margin of Error (+/-)**
Total:	163,912	2,914
Under .50	5,444	2,195
.50 to .99	6,127	2,226
1.00 to 1.24	1,969	952
1.25 to 1.49	4,361	2,013
1.50 to 1.84	6,885	2,448
1.85 to 1.99	3,150	1,607
2.00 and over	135,976	5,488
Want:		
	Estimate	**Margin of Error (+/-)**
Total	163,912	2,914
Under 1.00	11,571	2,421
1.00-1.99	16,365	3,679
2.00 and over	135,976	5,488

Third Example – Margin of Error of a Proportion

(e.g., What proportion of the State's poverty population lives in Baltimore City?)

X = number of people in poverty in Baltimore City
Y = number of people in poverty in Maryland

i.e. X is a subset of Y

$$SE(x/y) = 1/Y * \sqrt{[MOEx/1.64\,5]^2 - [x^2/y^2]*[MOEy/1.64\,5]^2}$$

OR

$$SE(x/y) = 1/Y * \sqrt{[MOEx/1.64\,5]^2 + [x^2/y^2]*[MOEy/1.64\,5]^2}$$

MOE (x/y) = SE(x/y)*1.645

Go to Statistical Calculations Excel File! (StdErrProportion)

Fourth Example – Margin of Error of a Ratio

(e.g. What is the ratio of median earnings of Females to Males in Baltimore City)

X = median earnings of females in Baltimore City
Y = median earnings of males in Baltimore City

i.e., X is NOT a subset of Y

$$SE(x/y) = 1/Y * \sqrt{[MOEx/1.645]^2 + [x^2/y^2] * [MOEy/1.645]^2}$$

MOE (x/y) = SE(x/y)*1.645

Go to Statistical Calculations Excel File! (StdErrRatio)

Thank You

Hope we made it (somewhat) easier