Mathematical Statisticians
at the
Bureau of Labor Statistics

BLS Open House
September 17, 2010

BLS
BUREAU OF LABOR STATISTICS
U.S DEPARTMENT OF LABOR

www.bls.gov

Agenda

- Introduction to BLS
- What is a Mathematical Statistician?
- What is the survey process at BLS?
- Where do Math/Stats work at BLS?
- So what do Math/Stats do?
- What's the work life like?
- What else do you want to know?

Who is the U.S. Bureau of Labor Statistics

- Principal fact-finding agency for the Federal Government in the broad field of labor economics and statistics.

- A politically independent agency within the Department of Labor.

- Part of the Federal statistical system that includes the Bureau of Economic Analysis (BEA) and the Census Bureau.

What does the U.S. Bureau of Labor Statistics do?

Our mission is to collect, process, analyze, and disseminate essential economic information to support public and private decision-making.

Yes, you have heard about us….

- The Unemployment Rate

- Consumer Price Index (CPI)

- Producer Price Index (PPI)

- Occupational Outlook Handbook

- Monthly Labor Review

- http://www.bls.gov/

Some things you may not know about us.

- American Time Use Survey

- Consumer Expenditure Survey

- Import/Export Prices

- Employment Cost Index

- Hurricane Katrina study

Why We Do It

- Provide factual and reliable information, not opinions, for use in decision-making
- Provide policy-makers with accurate data
- Provide information to researchers
- Provide information to job seekers and businesses
- Provide information for the media

How is the Bureau Organized?

■ BLS is broadly organized with program and support offices

  ▶ Program Offices:
    – OPLC, OPT, OCWC, OEUS

  ▶ Support Offices:
    – OCOMM, OFO, OTSP, OA OPUBSS, OSMR

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How is the Bureau Organized?

BLS Headquarters in Washington, D.C.

How is the Bureau Organized?

There are also 6 Regional Offices:

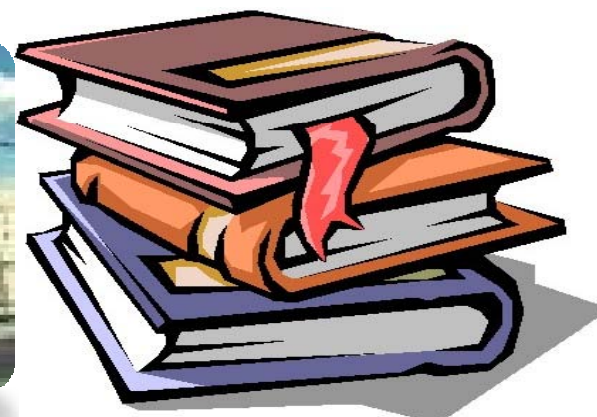|	
Atlanta	Boston/New York
Chicago	Dallas/Kansas City
Philadelphia	San Francisco

Plus office locations in other U.S. metropolitan areas.

Where and how do we get our data?

- From representative industries and households across the country

- From other Government agencies

- From publications and web sites

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- From publications and web sites

- From Direct collection

What Occupations are available?

- Economists/Statisticians

- Mathematical Statisticians

- Information Technology Specialists

- Other:
  - ▶ Program Analysts, Budget Specialists, HR Specialists, Psychologists, Accountants, Procurement Specialists

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What is a Mathematical Statistician?

A trained professional who provides the statistical support for one or more surveys and products of the Agency.
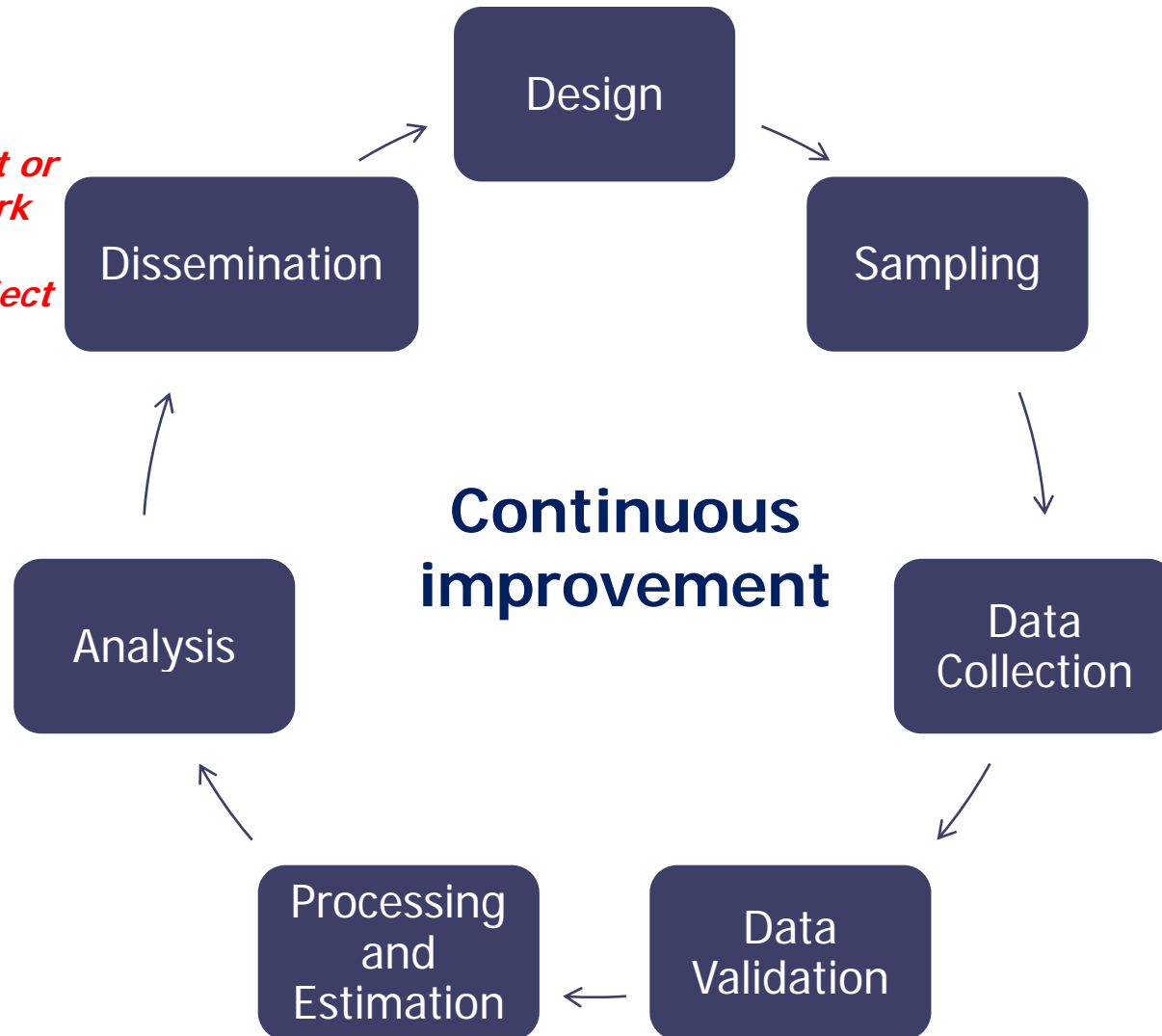
In general terms . . .
- Economists – Define what needs to be measured
- Math-Stats – Figure out how to make it happen
- IT Specialists – Make it happen
- Admin/HR Staff – Support us all

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The content big picture: the work we do at BLS

Most BLS positions involve direct or support work related to these project stages

Design

Sampling

Dissemination

Continuous improvement

Analysis

Data Collection

Processing and Estimation

Data Validation

1. Design

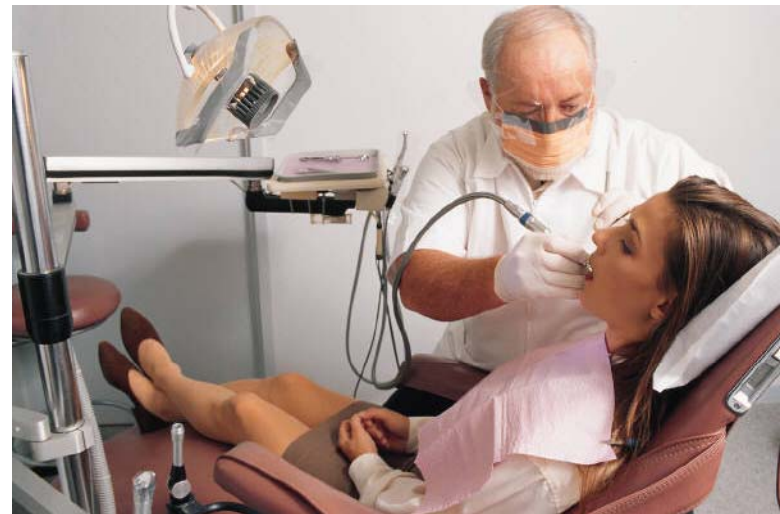is the process we use to prepare to do a survey. It includes decisions about:

- What?
- Who?
- When?

- Where?
- How?

Math-Stats, Economists,
IT Specialists,
Budget & Human Resources

2. Sampling

Deciding *whom*,
specifically,
to collect data from.

Math-Stats,
Regional Office Economists &
Economic Assistants

Sampling - continued

- **BLS statistics are compiled using well-accepted statistical methods**
- **Some use information from businesses, while others survey households**
- **BLS uses censuses and samples**
  - ▶ Census
    - When collection from the entire population is beneficial and cost effective
    - Sometimes necessary for small populations or rare events
  - ▶ Sample
    - Generally used

Sample Units

The sample unit is
- ► An individual
- ► A household
- ► A business

Sample Frame

- A Sample Frame is a list of units within the target population of interest
  - All business establishments in an industry
  - All households in New York City
- Sample units are selected from the sample frame

Where do we get sample frames?

- Household surveys
  - ▶ Census data containing housing units within a neighborhood
  - ▶ Address lists developed by private companies
  - ▶ Random digit dialing
- Establishment surveys
  - ▶ Compilation of establishments based on mandatory State Unemployment Insurance records
- Other surveys
  - ▶ Telephone Point of Purchase Survey

Sampling Methodology

- **Non-probability sampling**

- **Probability Sampling**

  ▶ Simple Random Sampling (SRS)
    – All members of the sample frame have the same chance of selection (and each sample of the same size has an equal chance of being selected)

  ▶ Probability Proportional to Size (PPS)
    – The chance that each unit has of being selected is proportional to a measure of size (e.g. employment size or company revenue)

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Sampling Methodology

▶ **Multi-Stage Sampling**

– combine simple methods to address our sampling needs in the most efficient and effective manner possible

– Used by many BLS programs

Example: cluster sampling (select distinct geographic areas) followed by stratified sampling (select establishments in a particular industry)

2009 Revision
CPI and CE PSUs

3. Data Collection

- Contacting sample units to obtain the desired data
- Methods used at BLS:
  - ▶ Mail
  - ▶ Telephone
  - ▶ Internet
  - ▶ Personal Visit
  - ▶ Computer Assisted Interviews
  - ▶ File Transfer

Regional Office Economists. Economic Assistants, & State Partners

4. Data Validation

- Reviewing collected data to ensure it is valid and accurate

- Methods used at BLS:
  - Data edits
  - Outlier identification
  - Respondent recontact

National Office Economists & Regional Office Economists

5. Processing & Estimation

- Preparing data for computations
- Computing survey estimates and variances
- Types of BLS estimates:
  - ▶ Indexes
  - ▶ Totals
  - ▶ Means
  - ▶ Rates
  - ▶ Percentiles

Math-Stats, Economists, & IT Specialists

6. Analysis

- ■ Ensuring computed estimates make sense and can be explained

- ■ Using BLS data in new ways to explain what is happening in the U.S. economy

National Office Economists,
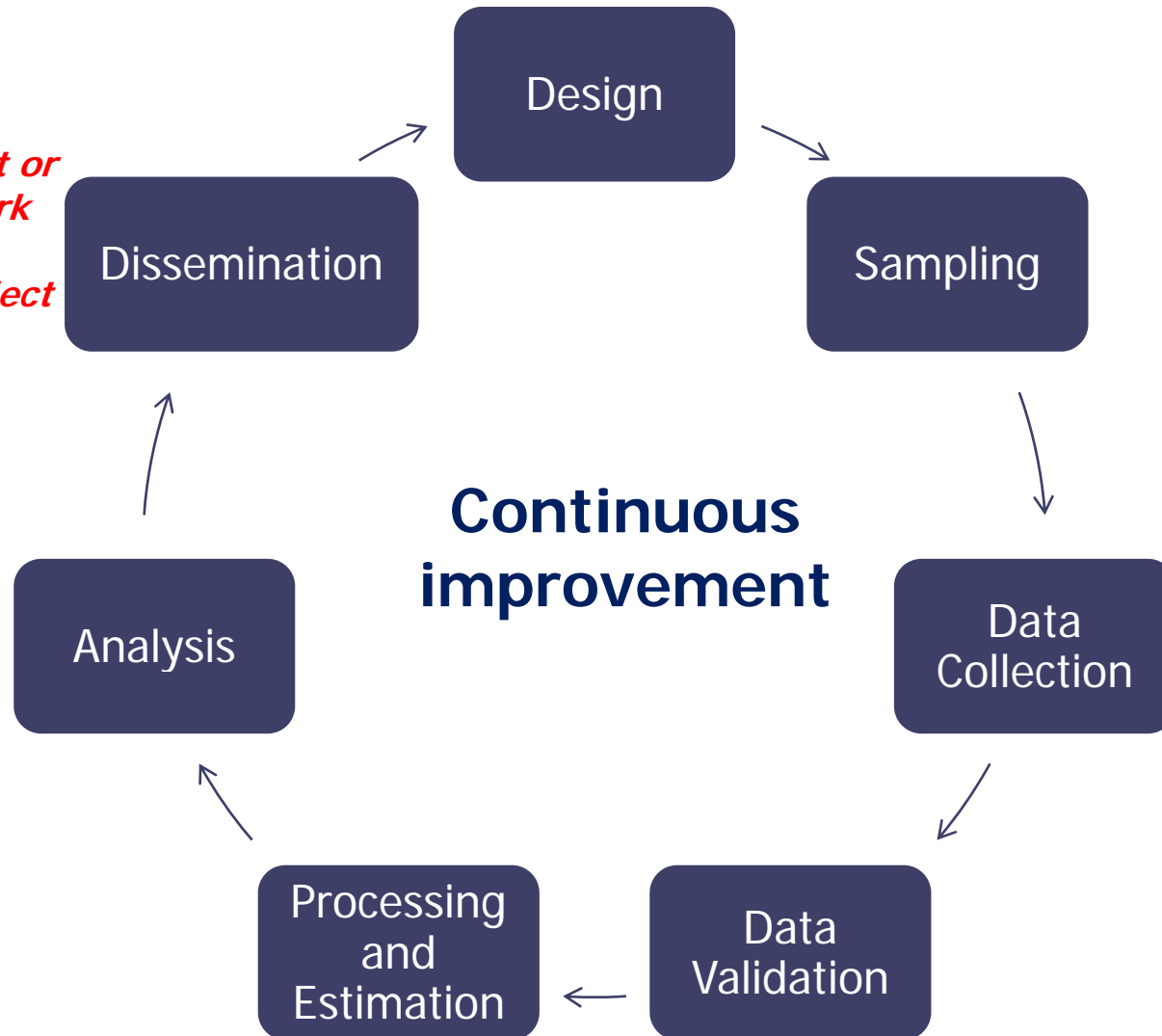Regional Office Economists,
& State Partners

7. Dissemination

- Releasing data to the public, policy makers, other government users

- Answering questions about BLS data

- Methods used at BLS:
  - ▶ Internet
  - ▶ Economic press releases
  - ▶ Paper documents
  - ▶ Magazines
  - ▶ Technical reports

National Office Economists & Regional Office Economics

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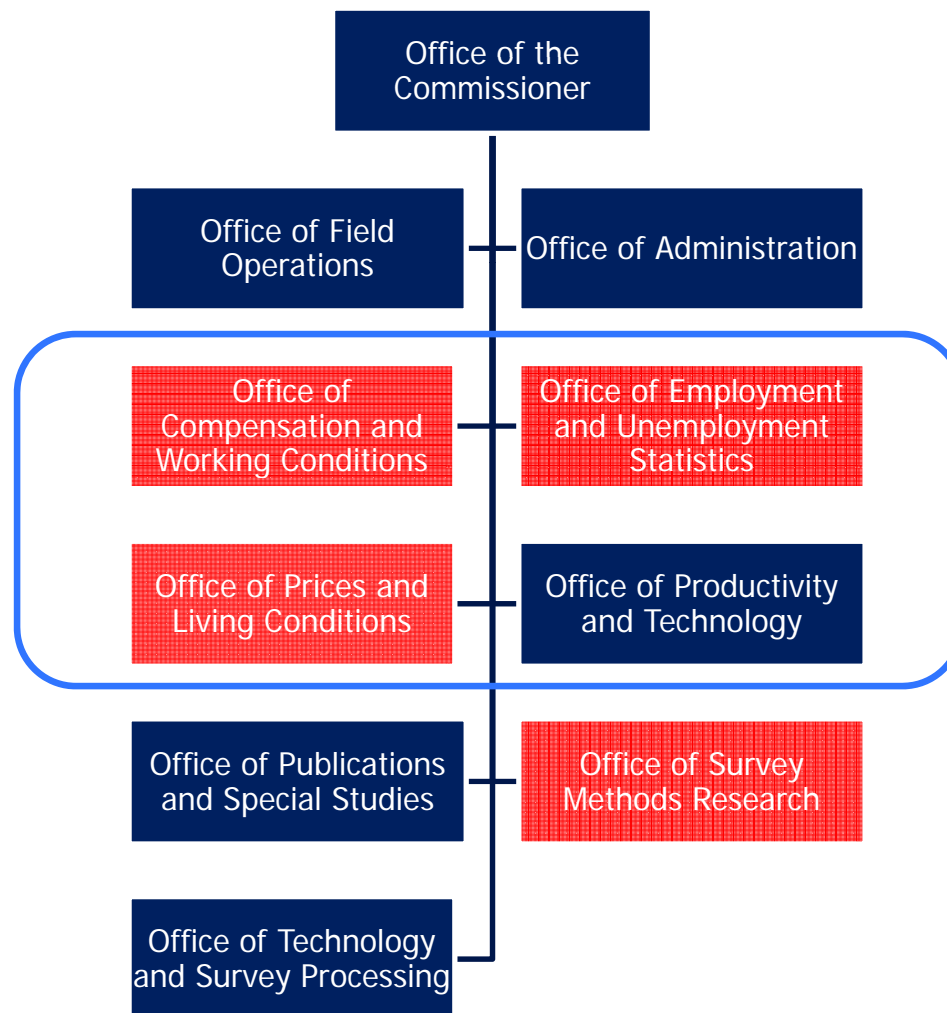
Data Validation

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Where do Math/Stats work at BLS?

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Program
Offices

| Office of Compensation and Working Conditions | Office of Employment and Unemployment Statistics |
| Office of Prices and Living Conditions | Office of Productivity and Technology |

| Office of Publications and Special Studies | Office of Survey Methods Research |

Office of Technology and Survey Processing

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Duties of Mathematical Statisticians in the Program Offices

- Developing and refining sampling frames using data analysis and computer programming
- Developing and implementing sample designs
- Selecting samples and verifying their statistical accuracy
- Researching and developing techniques in estimation, analysis of variance, imputation and other topics

Duties of Mathematical Statisticians in the Program Offices

- Analyzing sample response rates
- Evaluating the statistical accuracy, efficiency, and quality of BLS surveys and procedures
- Developing requirements for statistical reports and systems
- Testing computer systems to ensure that they meet statistical requirements

Duties of Mathematical Statisticians in Survey Methods Research

Conduct research to improve BLS survey methodology. Recent projects include:

- The study of theoretical and empirical properties of replication variance estimators

- Imputation procedures for missing establishment data

- Research and evaluation of small domain estimators

- Evaluation of alternative seasonal adjustment procedures for time series

A Typical Day in the life of a Math/Stat at BLS

- There is no such thing!
- Typical types of work include
  - ▶ Production
  - ▶ Statistical Research
  - ▶ Systems Development & Testing
  - ▶ Statistical Writing
- The amount of time you spend on each of these types of work will vary.

Am I qualified?

To be a math/stat, you must have

- a bachelor's degree or higher
- 24 semester hours in math/statistics
  - at least 12 hours at or above calculus level
  - 6 hours in statistics

Math/Stat Entry Levels

GS – 7

- Cumulative GPA of 2.95 or higher, OR
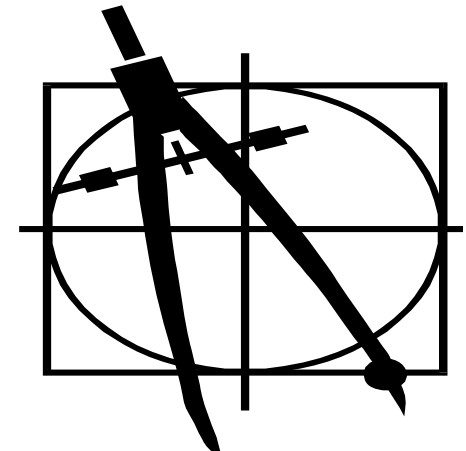- GPA of 3.45 or higher in the major field of study

GS – 9

- Master's degree in math or statistics

GS – 11 or 12 Research Position

- Doctorate degree in math or statistics

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Desirable Education & Experience for Mathematical Statisticians

- Course work specific to sampling theory and techniques and probability

- Course work specific to one year of higher-level mathematics (Vector Analysis, Differential Equations)

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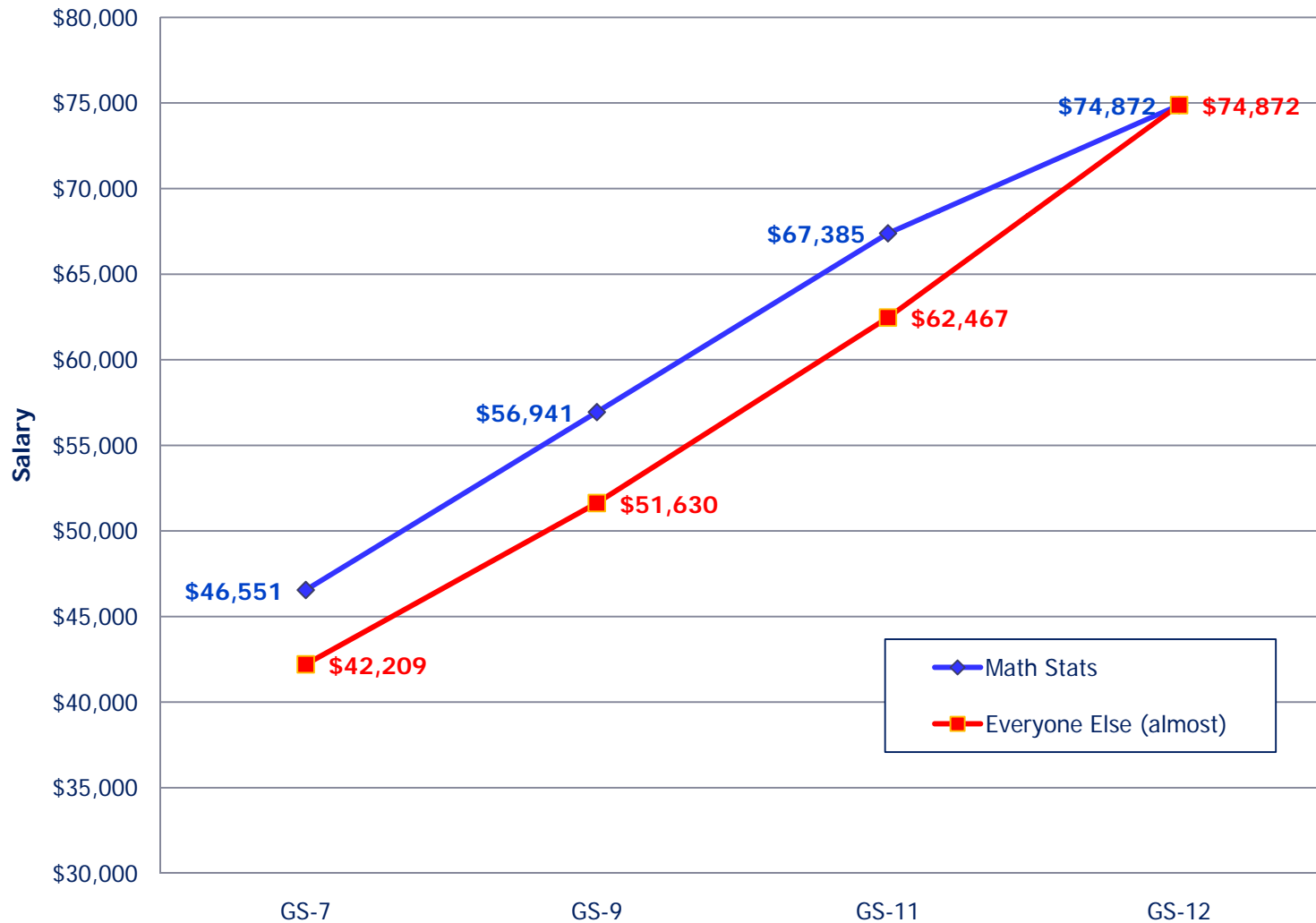- What else do you want to know?

Training

- On the job
- Graduate school
- Joint Program in Survey Methodology
- BLS-sponsored classes
- Participation in professional associations and conferences
- Certifications

Career Path and Promotional Opportunities

- Math Stats generally start at a GS-7 or GS-9.

- Math Stats are eligible to receive non-competitive promotions up to GS-12.
  - With one year in each grade.
  - With acceptable level of performance.

- Beyond the GS-12 level, technical and supervisory positions are available on a competitive basis.

Math Stat Salaries
Washington, D.C.

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