Adjusting Industry Measures of Hours Worked for Labor Composition

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What is labor composition?

■ An adjustment to labor hours used in productivity measurement that accounts for the skill composition of the workforce

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Project Overview

- Labor composition used in:
  - ▶ BLS industry-level multifactor productivity (MFP)
  - ▶ BEA-BLS industry-level production accounts (ILPA)
- Goals
  - ▶ **Share** a single methodology
  - ▶ **Improve** upon the existing methodologies
  - ▶ **Expand** coverage to more detailed industries (NAICS 4-digit)

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Project Overview

- Improved methodology
  - ▶ Combines information from both the ACS and CPS
  - ▶ Small area estimation to handle thin cells
- Agencies differ on how available data is being used but agree on general framework

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How is labor composition calculated?

Change in labor composition

Change in hours worked, weighted by labor cost shares

Change in hours worked

$$\Delta \ln LC_{t,i} = \left(\sum_i \bar{v}_{t,i,j} \, \Delta \ln H_{t,i,j}\right) - \Delta \ln H_{t,i}$$

- t = year
- i = industry
- j = specific age, education, sex, class of worker group
- v = average labor cost share of t and t-1

- LC = labor composition
- H = hours worked

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Worker Groups

- A unique combination of the following:
  - ▶ NAICS industries
    - – 63 (2-digit, 3-digit)
    - – 303 (4-digit)
  - ▶ 7 age
  - ▶ 6 education
  - ▶ 2 sex
  - ▶ 2 class of worker

7*6*2*2 = 168 workers per industry

168*63 industries ~ 11,000 workers

168*303 industries ~ 51,000 workers

Age	Definition
1	0-16
2	16-17
3	18-24
4	25-34
5	35-44
6	45-54
7	55-64
8	65+

Education	Definition
1	Grade 8 or less
2	Grades 9-12
3	HS Diploma
4	Some college
5	Bachelor's
6	More than a bachelor's

Sex	Definition
1	Male
2	Female

Class	Definition
1	Payroll
2	Self-employed

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Published Methodology – Data Source

- BLS
  - ▶ Basic Monthly Current Population Survey (CPS)
- BEA
  - ▶ Decennial Census
  - ▶ CPS Annual March Supplement (CPS ASEC)
  - ▶ Iterative proportional fitting (RAS)
    - – Maintains worker group proportions from Census
    - – Adjusts levels to match marginal totals in ASEC

Current Issues

- **Thin cells** – groups with low number of observations
- Missing wage data
- Groups that drop in and out of the time-series
- Changes to Decennial Census starting in 2010
  - ▶ Income, education, and employment information moved to annual American Community Survey (ACS)

ACS vs. CPS - Similarities

- Household surveys
- Data collected monthly
- Data released annually
- Industry, age, sex, education, class of worker available
- Hours and wages available

ACS vs. CPS - Differences

Topic	ACS	CPS
Main purpose	Population demographics	Unemployment rate
Reference period	Previous 12 months	Last week
Multiple job holders	No data	Second job data
Time-series	Starts in 2003	Starts in 1960s

ACS vs. CPS – Sample Size

- Current Population Survey (CPS)
  - ▶ March Supplement (ASEC) – 98,000 households per year
- American Community Survey (ACS)
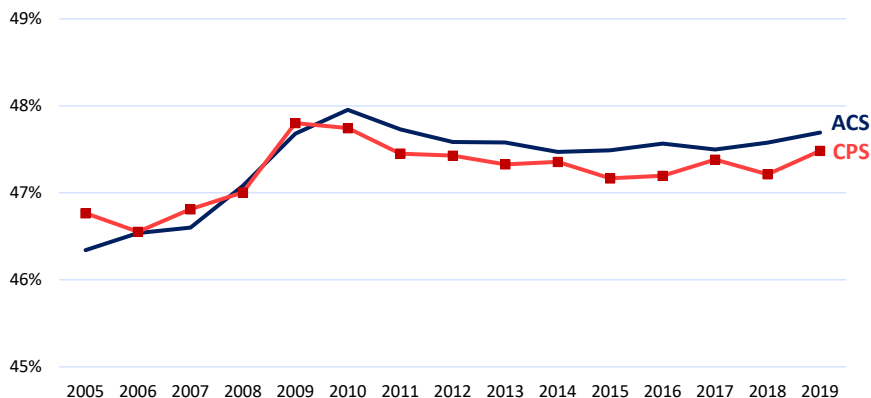 - ▶ 3.5 million housing units per year

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ACS vs. CPS

Female Share of U.S. Workforce

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ACS vs. CPS

Percent of U.S. Workforce with at least a Bachelor's degree
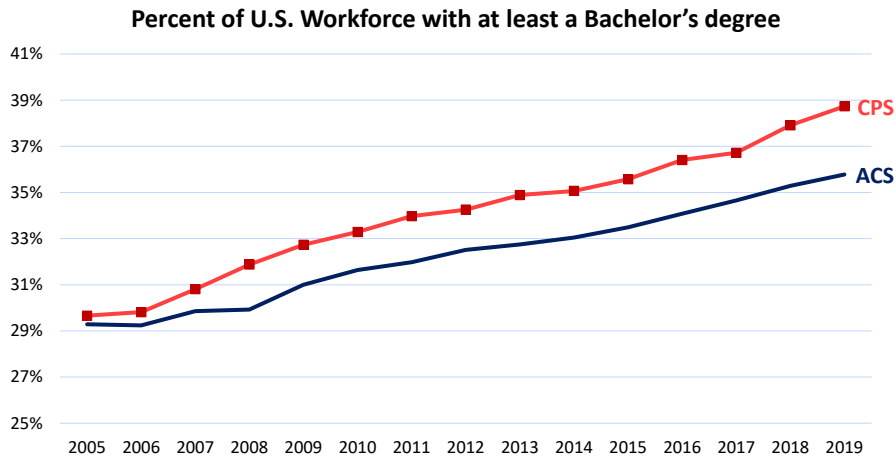
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ACS vs. CPS - Takeaway

- CPS – labor force focused
  - ▶ Concepts of hours and wages more suitable
- ACS – general population focused
  - ▶ Demographic composition
- Which one should we use?

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Matrix Balancing (RAS)

- Use estimates from the ACS
- Scale ACS estimates to CPS-ASEC using RAS
    - Age by education by sex marginal totals
    - For employment, hours, and wages
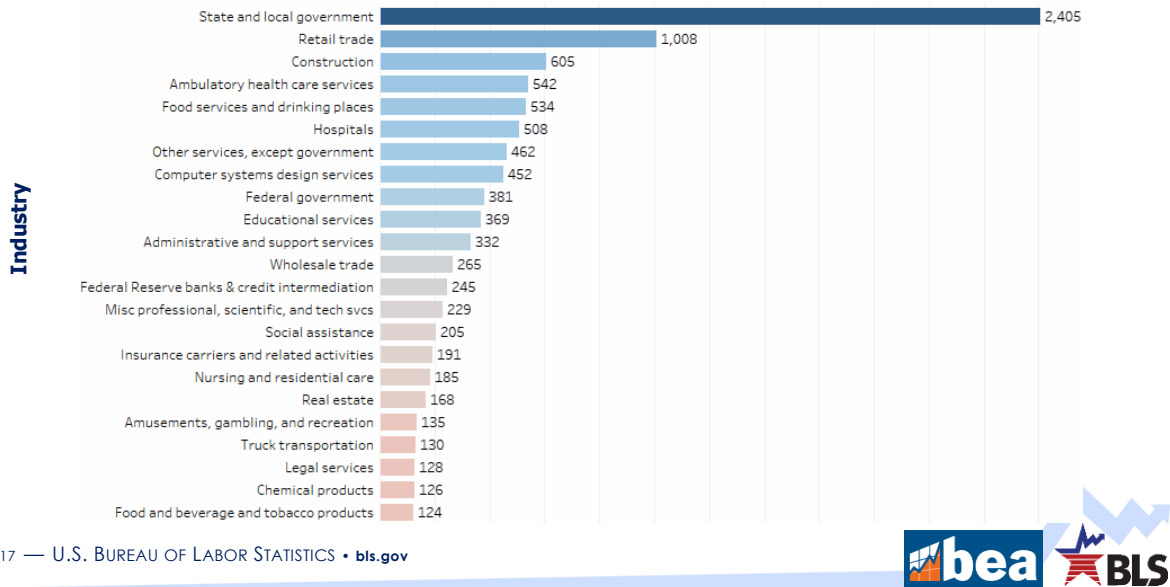- Similar to BEA approach with Decennial Census

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Multiple Job Adjustment

- ACS and CPS ASEC don't have information about secondary jobs
    - CPS Outgoing Rotation Weights (ORG) has information
- Identify what portion of employment and hours belong to a secondary industry
    - Ex. 2% of workers who reported construction as their primary industry work in restaurants as well
- Apply information to the ACS

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Average Cell Size by Industry in 2017

Industry	Value
State and local government	2,405
Retail trade	1,008
Construction	605
Ambulatory health care services	542
Food services and drinking places	534
Hospitals	508
Other services, except government	462
Computer systems design services	452
Federal government	381
Educational services	369
Administrative and support services	332
Wholesale trade	265
Federal Reserve banks & credit intermediation	245
Misc professional, scientific, and tech svcs	229
Social assistance	205
Insurance carriers and related activities	191
Nursing and residential care	185
Real estate	168
Amusements, gambling, and recreation	135
Truck transportation	130
Legal services	128
Chemical products	126
Food and beverage and tobacco products	124

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Small Area Estimation – Big Picture

- Some cells have very few observations ➜ high standard error
- Use SAE to get a more accurate estimate

$$SAE\ estimate_i\ = \gamma_i(Survey\ estimate_i) + (1 - \gamma_i)(Model\ estimate_i)$$

$$\gamma_i = \frac{Model\ standard\ error}{Survey\ standard\ error_i + Model\ standard\ error}$$

- The higher the survey standard error, the less weight given to the survey estimate

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Small Area Estimation - Model

Cell estimate from the
ACS 1-year

Cell-specific random
effect

$$\bar{y}_i = x_i\beta + \mu_i + \bar{\varepsilon}_i$$

Set of predictors

Standard error of $\bar{y}_i$ (calculated
from replication weights)

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Small Area Estimation - Specification

■ A model for each
  ▶ Worker group (168) – Number of observations = number of industries
  ▶ Year (15)
  ▶ Measure (4)
    1. Group's employment share within industry
    2. Weekly hours worked
    3. Weeks worked
    4. Hourly wage

■ 168 worker groups * 15 years * 4 measures ~ **10,000 models**

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Small Area Estimation – Predictors

- ACS 5-year (ex. 2015-2019)
  - ▶ Larger sample size
  - ▶ Point estimate for a 5-year time period
  - ▶ Potential smoothing effect
  - ▶ Use data for the same cells that exist in the ACS 1-year
- CPS ASEC
  - ▶ Independent estimate
  - ▶ Use 3-digit data that is available in all years
  - ▶ Counteract some of the smoothing from ACS 5-year

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Small Area Estimation – Simple Example

ACS 1-year

Industry	Age	Education	Sex	Class of Worker	Year	Avg. Weekly Hours	Standard Error
Oilseed and Grain Farming (1111)	45-54	Bachelor's	M	Employee	2018	41	10
Automobile Dealers (4411)	45-54	Bachelor's	M	Employee	2018	43	5

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Small Area Estimation – Simple Example

ACS 5-year

Industry	Age	Education	Sex	Class of Worker	Year	Avg. Weekly Hours
Oilseed and Grain Farming (1111)	45-54	Bachelor's	Male	Employee	2018	40.8
Automobile Dealers (4411)	45-54	Bachelor's	Male	Employee	2018	43.2

CPS ASEC

Industry	Age	Education	Sex	Class of Worker	Year	Avg. Weekly Hours
Farms (111,112)	45-54	Bachelor's	Male	Employee	2018	39.5
Retail Trade (44,45)	45-54	Bachelor's	Male	Employee	2018	42.8

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Results

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Charted Methodologies

- ACS – labor composition using ACS without adjustments
- BEA – published BEA labor composition
- BLS – published BLS labor composition
- Shared – proposed shared methodology

Question to TAC

- The research team based its empirical strategy on expert judgements on the time series volatility of the labor composition series by industry.
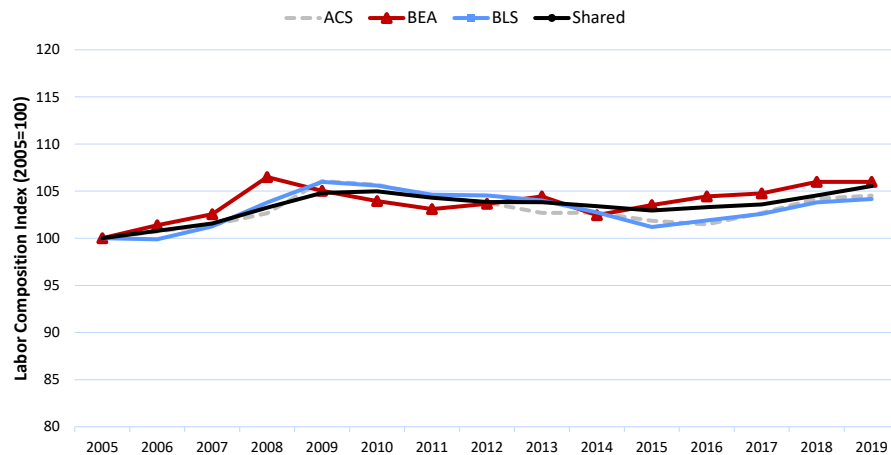- What methods can be used to determine if a labor composition series is too volatile to use?

Total Economy (TE)
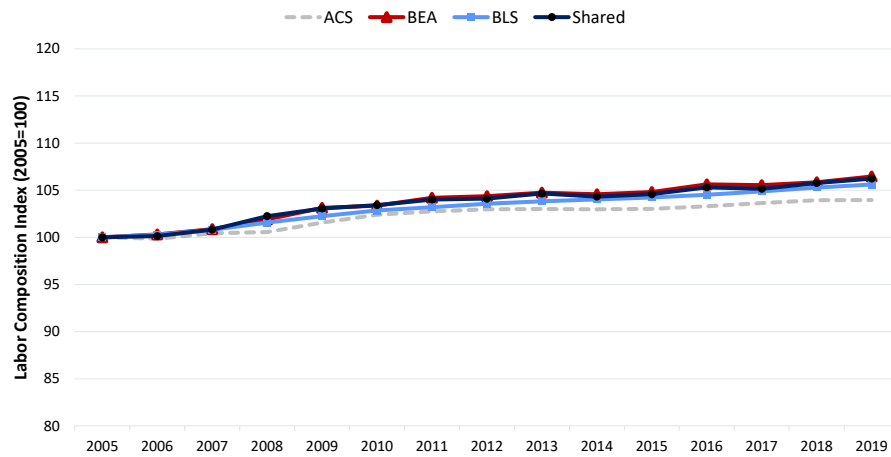
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Motor Vehicle Manufacturing (3361MV)

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Retail Trade (44RT)
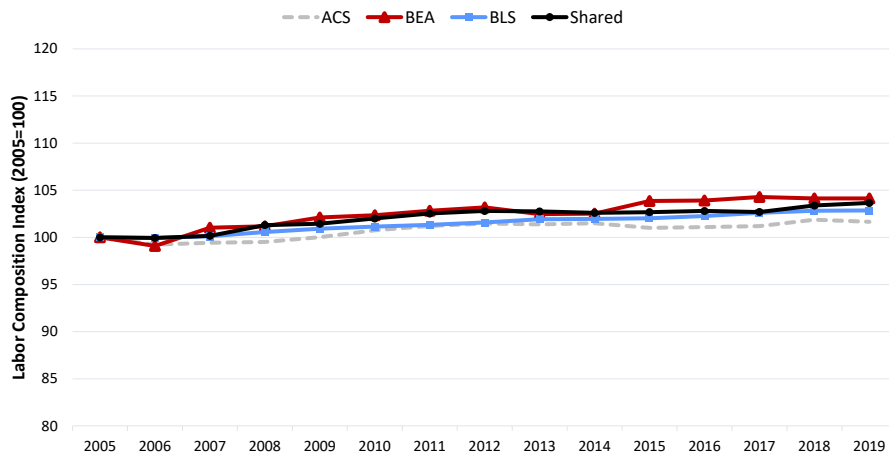
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Management of Companies and Enterprises (55)
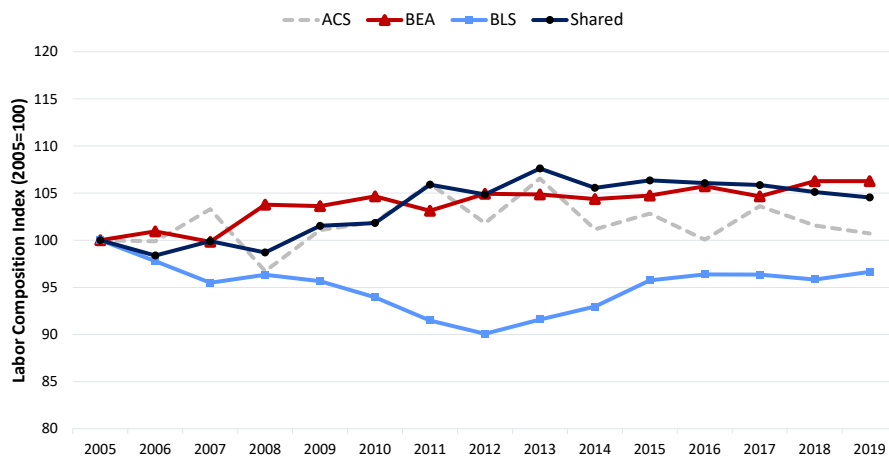
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Plastics Product Manufacturing (3261)
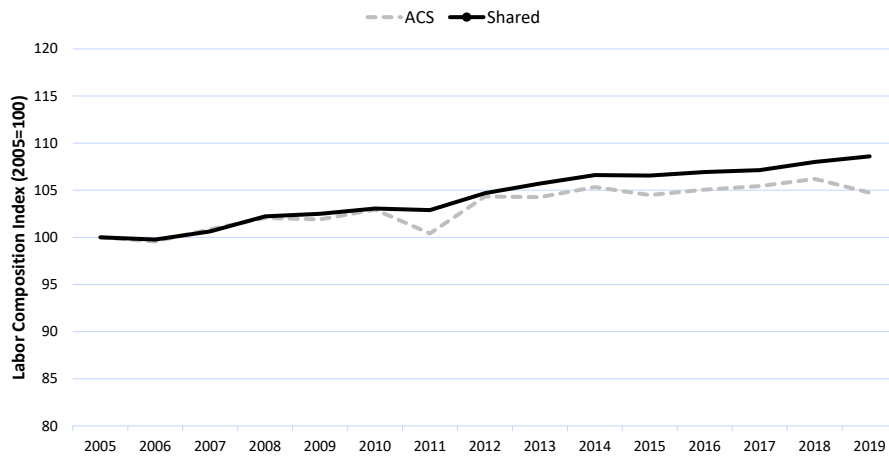
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Sound Recording Industries (5122)
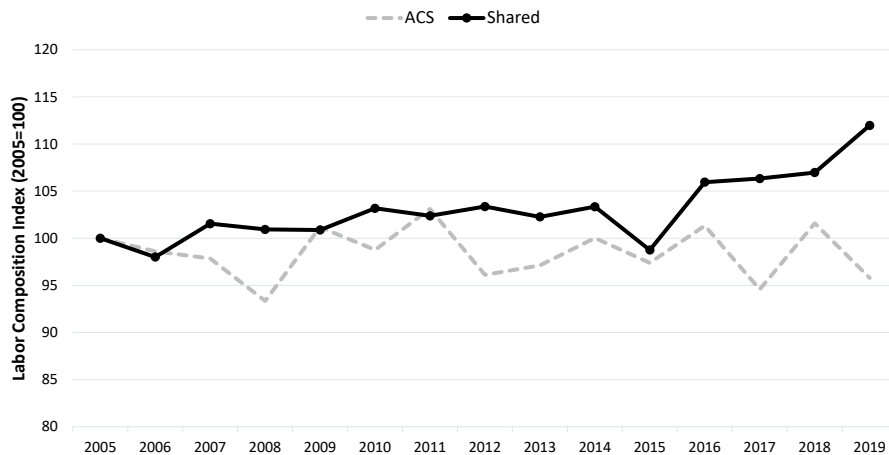
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Question to TAC

- Able to compare three-digit labor composition to existing methods
  - ▶ These comparisons are not available at the four-digit level
- What is an acceptable (or reasonable) level of volatility in the 4-digit series in comparison to the 3-digit to publish this level of detail?

Question to TAC

- The Biden Administration released an executive order about including demographic information in economic statistics and the labor composition adjustment is implemented by tracking workers by demographic group. Thus, this work yields detailed data on labor market outcomes by demographic group that would be covered by the Executive Order.
- If BLS is considering releasing the underlying detail on the cross-classification of workers, what issues should we be prepared to confront if we use the proposed method, what additional demographic groups should be prioritized, and what potential issues and caveats should BLS be aware of in its presentation of expanded labor data by demographic group?

Conclusion

- Improved methodology for labor composition
  - ▶ Combines strengths of ACS and CPS
  - ▶ Small area estimation to address thin cells
- Shared methodology for both BEA and BLS
  - ▶ Will be introduced in near future
  - ▶ Working paper submitted to TAC

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