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Overview

The Local Area Unemployment Statistics (LAUS) program produces county-level total employment for all counties through a building block method.

- Current LAUS substate estimates use statewide agricultural employment from the Current Population Survey (CPS) and allocates to counties using the American Community Survey (ACS).
- Seasonal factors thus represent statewide variation spread across counties.
- Alternative agricultural employment data available for counties through administrative Quarterly Census of Employment and Wages (QCEW) with local over-the-month variation.

This study: apply X-13 to identify counties with seasonal agricultural employment using administrative QCEW data and examine feasibility of producing reasonable forecasts.

- Expect agricultural employment to be highly seasonal at the local level.

Data

Monthly agricultural employment (NAICS 11 minus logging) time series by county or county equivalent in the U.S. and Puerto Rico with $N = 2,815$ with strictly non-zero agricultural employment.

- Data sourced from the QCEW published by the BLS and cover July 2001 through March 2024 with $T = 273$.
  - Represents all agricultural employment covered under the Unemployment Insurance (UI) system or about 1.5 million workers in 2023 (annual average) (U. S. Bureau of Labor Statistics 2024).
- Coverage in the QCEW varies state-by-state due to differences in agricultural coverage in the UI system.
  - Complete coverage of farms and farm labor contractors in Arizona and California (U. S. Bureau of Economic Analysis 2021).
  - Some state labor market information offices develop their own estimates using alternative approaches.
- Important to note that QCEW counts jobs by *location* and not by *residence*.
  - LAUS counts employment on a residency basis.

Methodology

Use X-13 to seasonally decompose county time series into trend, seasonal and irregular components through automatic model selection and outlier detection.

- Screen areas with seasonal ARIMA component, significant model-based F (MBF), and significant QS tests (Bell et al. 2022).

- Compute seasonality strength index from Hyndman and Athanasopoulos (2021) to sort seasonal areas into weakly and strongly seasonal areas,

$$\text{Strength}_i = \max\left(0, 1 - \frac{\text{Var}(I_{it})}{\text{Var}(I_{it} + S_{it})}\right), \quad \forall i,$$

where I_t and S_t are the irregular and seasonal components, respectively.

Given long time series, standard tests may suffer weaknesses.

- QS test only examines first two seasonal autocorrelations, may be deeper patterns.
- MBF only detects for stable seasonality.

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Results

Comparing a few seasonality tests shows most specifications contained seasonal AR or MA terms and rejected both the MBF and QS tests.

- Most automatically selected models were the default airline model.

- QS had slightly lower rejection rates than MBF.

- Areas with larger seasonal strength indexes tended to have QS statistics above 150.
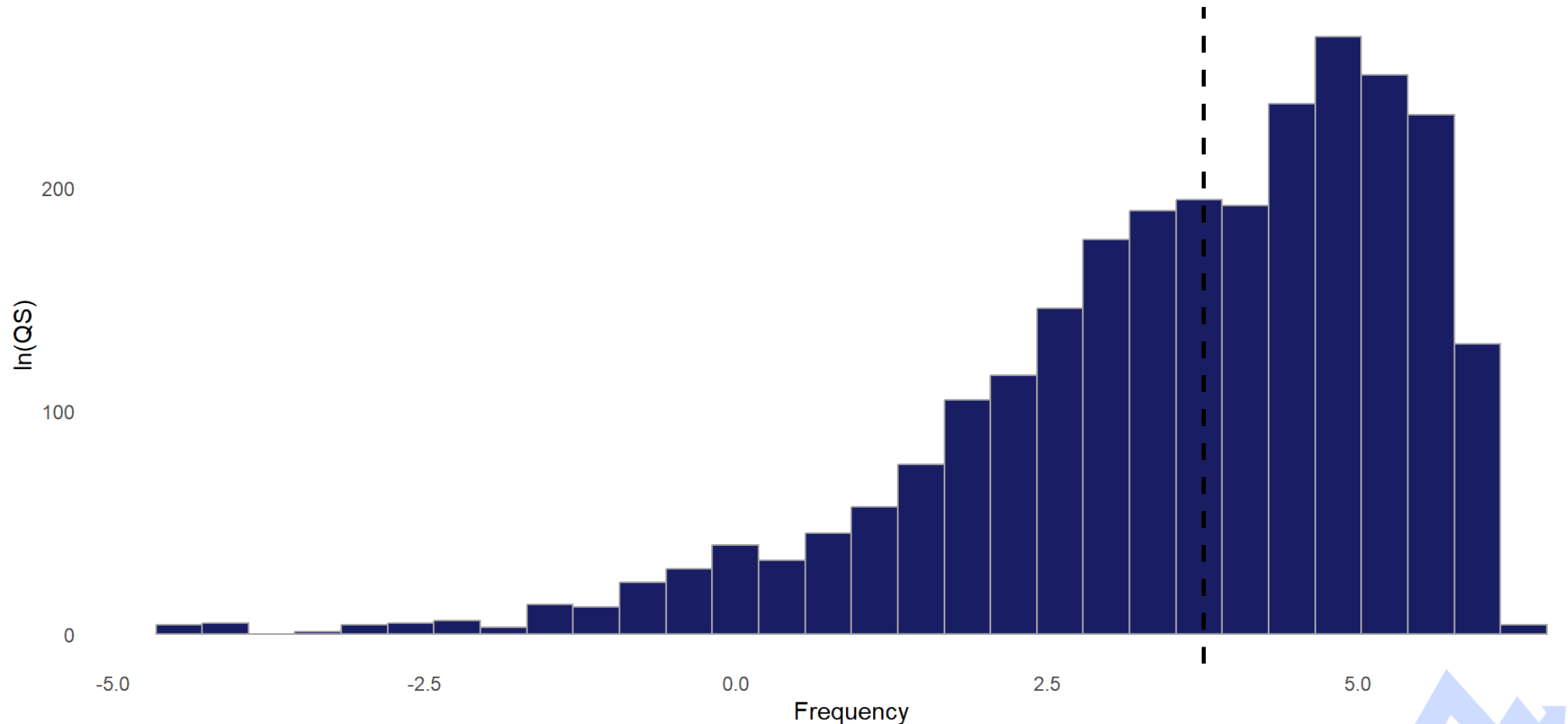
Strength Quantile	Seasonal AR/MA	MBF Sig.	QS Sig.	QS > 150
1	638	527	286	7
2	694	660	540	30
3	695	677	664	170
4	695	684	691	433
NA	19	41	20	0

Notes: Significance determined at the 95% level.

QS Test Statistic Distribution

QS statistics were especially large and left skewed, showing very high rejection rates.

Distribution of the QS Statistic for Seasonality

Notes: Dashed line denotes the 50th percentile.

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Seasonality Strength Distribution

Seasonality strength index shows slightly more variation, although still a strong left skew.

Distribution of the Seasonality Strength Statistic Index

Notes: Dashed line denotes the 50th percentile.

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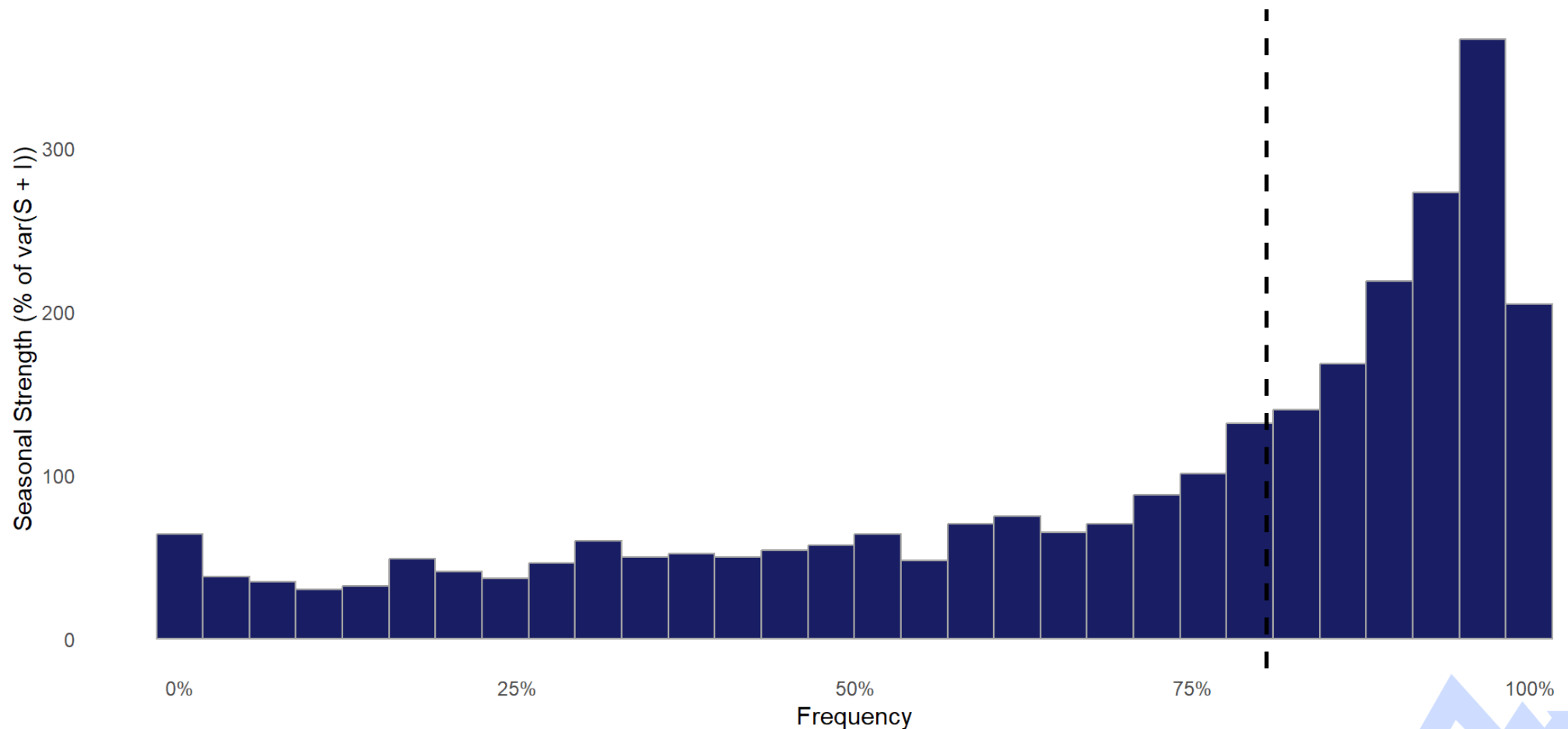
Discussion

QCEW administrative data show highly seasonal agricultural employment across substate areas as measured by standard seasonality tests.

- Standard QS and MBF tests appear overpowered given long time series.

- Overlaying standard tests from X-13 with additional metrics, such as seasonality strength, may help prevent over-identifying seasonal areas.

- As expected, agricultural employment was *highly seasonal* across multiple tests.

Further work will further refine seasonality testing.

- Add tests for moving seasonality, examine deeper seasonal autocorrelations.

- Examine spatial relationships between seasonal factors.

    - Spatial correlation may derive from similar farm types, commuting flows.

- Produce and evaluate county agricultural employment forecasts as research data.

    - Local-level seasonal variability from administrative data could help refine LAUS estimation.

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