

# ANALYZING THE EFFECT OF MINIMUM WAGE INCREASES ON PART-TIME EMPLOYMENT IN THE U.S.: A TIME SERIES ECONOMETRIC STUDY USING R

## 1. Background

Following multiple minimum wage increases across U.S. states in the past decade, policy stakeholders sought empirical evidence on how these changes influenced part-time employment levels. Concerns centered around potential substitution effects, where employers might reduce full-time roles or limit hours.

We conducted a state-level time series analysis using R to assess the short-run and long-run effects of minimum wage revisions on part-time employment, using the ARDL approach to address mixed order integration.

## 2. Objective

- To measure the impact of state-level minimum wage increases on the share of part-time workers
- To distinguish between short-run adjustments and long-run equilibrium effects
- To assist state labor departments and advocacy groups in policy formulation

## 3. Data Used

### Sources:

- U.S. Bureau of Labor Statistics (BLS) – Employment by State
- U.S. Department of Labor – State Minimum Wage History
- Federal Reserve – Macroeconomic Control Variables

### Time Period:

- Monthly data from **January 2010 to December 2023** (168 observations)

### Key Variables:

- Dependent: `Part_Time_Employment_Rate` (percentage of employed workers working <35 hours/week)
- Independent: `Real_Minimum_Wage` (adjusted for inflation using CPI)

- Controls: Unemployment\_Rate, Labor\_Force\_Participation, GDP\_Growth

## 4. Econometric Methodology

### 4.1 Stationarity Testing

- Augmented Dickey-Fuller (ADF) and KPSS tests confirmed mixed integration:
  - Part\_Time\_Employment\_Rate  $\sim I(1)$
  - Real\_Minimum\_Wage  $\sim I(0)$

### 4.2 ARDL Model Specification

ARDL(2,1,2,1) was selected based on auto\_ardl() in ARDL package.

```
model <- auto_ardl(Part_Time_Employment_Rate ~ Real_Minimum_Wage +
  Unemployment_Rate + Labor_Force_Participation + GDP_Growth,
  data = wage_data, max_order = 4, ic = "AIC")
```

### 4.3 Bounds Testing

- Conducted Pesaran Bounds Test to confirm cointegration
- Short-run dynamics and long-run coefficients extracted from ardl\_ecm() output

## 5. Model Results

| Variable                  | Short-Run Coefficient | Long-Run Coefficient | p-value |
|---------------------------|-----------------------|----------------------|---------|
| Real_Minimum_Wage         | -0.038 (lagged)       | <b>-0.145</b>        | 0.002   |
| Unemployment_Rate         | +0.12                 | +0.28                | 0.011   |
| Labor_Force_Participation | -0.08                 | -0.19                | 0.034   |
| GDP_Growth                | -0.04                 | -0.09                | 0.047   |
| Adjusted R <sup>2</sup>   |                       | 0.81                 |         |

## 6. Interpretation and Recommendations

- A \$1 increase in real minimum wage leads to a **14.5% long-run reduction** in the part-time employment rate

- Suggests substitution toward full-time work or labor force exits from marginal part-time roles
- **Short-run effects are weaker**, indicating gradual employer adjustment
- Macroeconomic context matters: unemployment and GDP growth significantly influence part-time dynamics

#### Recommendations:

- State labor departments should **monitor part-time trends post-reform** for 12–18 months
- Policy design should be **complemented with employer incentives** to encourage full-time retention
- Results support **structured phase-in** of wage hikes to mitigate short-run employment shocks

## 7. Reporting Output

- **R Markdown Report (PDF, 22 pages):**
  - Step-by-step ARDL diagnostics
  - Cointegration tests and residual analysis
  - Visual interpretation of impulse response and lagged effects
- **Excel Dashboard:**
  - Year-wise wage policy changes
  - Part-time vs. full-time ratios before and after each hike
  - Forecast section using long-run ARDL coefficients
- **Code Base:**
  - Full reproducible .R script for ARDL modeling and visualizations
  - Documentation on adapting the model to other states or control variables

## 8. Practical Impact

- Presented to **California Policy Lab** for advisory on upcoming wage reforms
- Informed **minimum wage** **whitepaper** published by a labor rights NGO
- Encouraged creation of **new employment classification KPIs** in economic dashboards

- Model adapted for **state-level Senate hearing simulation tools**

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