Real Wage Prediction for Occupations in Nebraska

University of Nebraska -- Lincoln

YuJie Wen

Motivation

Inflation rate are constantly changing, it affects not only the real wage but also purchasing power of people. We would like to discover the dynamic relationship between nominal wage and Consumer Price Index (CPI). We delved deeper and developed the ratio of the growth rate of nominal wage relative to growth rate of CPI.

Objective

- Find out which occupations have non-stationary wage-CPI growth rate (Difference between growth rate of CPI and nominal wage fluctuated in a random fashion) over 2003-2018 time period.
- What industries are the non-stationary occupations in. Are they in a same industry or not?

Data(2003-2018)

Our datasets are Occupational Employment Statistics from U.S. Bureau of Labor Statistics, which describe employment and **wage estimates annually (May) over 800 occupations**, in our program, we focus on the wage data from 2003 to 2018. The other dataset is **Consumer Price Index(CPI)** from 2003 to 2018, which is also from U.S. Bureau of Labor Statistics.

Procedure

1. Since the dataset for Occupational Employment Statistics and CPI are computed annually. Therefore, the first step we going to do is to combine wage data from 2003 to 2018. By doing so, we realized that there are some "gaps" (one or two missing observations) among occupations in certain years. What we have done was to fill out the missing value using average value of the previous year and the following year of the missing year.
2. After filled out the gaps, we picked occupations that have at least 14 observations and imported them to statistical software called "Eviews".
3. Before we can predict the future value, we need to do unit-root test, a time series stationarity test, which is done in "Eviews".
4. After find out whether the data is stationary, we do a t-test that test whether the mean value is statistically different from 0.
5. We can predict the future value that is the same as the latest value, if the time series data is stationary and the mean is not statistically different from 0.

Test and Software

Unit Root

AR(p) model:

$$y_t = \alpha + \theta_1 y_{t-1} + \theta_2 y_{t-2} + \cdots + \theta_p y_{t-p} + v_t$$

y_t is stationary if the roots of the equation:

$$\varphi(z) = 1 - \theta_1 z - \theta_2 z^2 - \cdots - \theta_p z^p$$

are greater than one in absolute value, which means the root satisfied $\varphi(z) = 0$. Then we conclude that y_t is stationary.

Test and Software (Continue)

Dickey-Fuller test for unit root

Dickey-Fuller Unit root test is a test for stationarity of time series data.

Null Hypothesis: The time series data contains a unit root (which means the time series data is nonstationary random walk)

Alternative Hypothesis: y_t is stationary around a nonzero mean. (Regard to the nature of the data, we run the test equation with intercept, but no trend)

Eviews

We use the statistics programming software "Eviews" to do the stationarity test for over 600 occupations in Nebraska.

(Sample ADF unit-root test in Eviews)

Augmented Dickey-Fuller Unit Root Test on RSTAR2S

Null Hypothesis: RSTAR2S has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=3)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.860709	0.0129
Test critical values:	1% level	-4.004425	
	5% level	-3.098896	
	10% level	-2.690439	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14

Rstudio

RStudio is a statistic programming software that we used to do the t-test using the time-series data exported from Eviews.

Function: t.test

Null Hypothesis: the mean value of the time series data is not statistically different from zero. (H0: mu = 0)

Alternative Hypothesis: the mean value of the time series data is statistically different from zero. (H1: mu ≠1)

Result

- Among 615 occupation, the non-stationary occupations are: **(Mental Health Counselors, Substance Abuse and Behavioral Disorder Counselors, Motor Vehicle Operators, Ambulance Drivers and Attendants, Molding Coremaking and Casting Machine Setters Operators, Tapers, Therapists, Legal Support Workers, Animal Scientists, Cutters and Trimmers, Gas Plant Operators, Plating and Coating Machine Setters Operators, Extruding and Drawing Machine Setters Operators, Bakers Recreational Vehicle Service Technicians, Automotive Service Technicians and Mechanics, Telecommunications Equipment Installers and Repairers, Real Estate Sales Agents, Funeral Attendants, First-Line Supervisors of Landscaping, Lawn Service, and Groundskeeping Workers, Opticians, Radiation Therapists, Dietitians and Nutritionists, Coaches and Scouts, Librarians, Recreation and Fitness Studies Teachers, Postsecondary Chemists, Landscape Architects, Architects, Except Landscape and Naval, Social and Community Service Managers, Industrial Production Managers, General and Operations Managers.)**
- 3 Transportation and Material Moving Occupations
- 2 Community and Social Service Occupations
- 6 Production Occupations 51
- 1 Construction and Extraction Occupations
- 4 Healthcare Practitioners and Technical Occupations
- 1 Legal Occupations
- 2 Life, Physical, and Social Science Occupations
- 3 Installation, Maintenance, and Repair Occupations 49
- 1 Sales and Related Occupations
- 1 Personal Care and Service Occupations
- 1 Building and Grounds Cleaning and Maintenance Occupations
- 1 Arts, Design, Entertainment, Sports, and Media Occupations
- 2 Education, Training, and Library Occupations
- 2 Architecture and Engineering Occupations
- 3 Management Occupations

Reference

- U.S. BUREAU OF LABOR STATISTICS. (2019, March). Occupation Employment Statistics Overview. Retrieved from: https://www.bls.gov/oes/oes_emp.htm#overview
- Hill, R. C., Griffiths, W. E., & Lim, G. C. (2018). Principle of Econometrics 5th Edition. Wiley.