IOWA Unemployment Insurance Claimants: A Comparison between α-Sutte Indicator and Other Forecasting Methods

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Abstract. This UI program if it isn't managed well so that can affect the insurance company performance and can make the company loss. One of the ways to know the development of this insurance claim for each month is that by forecasting the people who are interested in this insurance. The aim of this study is forecasting unemployment insurance claimants in IOWA, USA. This research uses ARIMA, NNETAR, Robus Exponensial Smooting, Theta Model, and α-Sutte Indicator forecasting method. The use of this method is intended to be compared the level of accuracy from various forecasting methods. To see the quality of the forecast, so that it will be used a comparison based on MSE score. The lower MSE Score, the better accuracy level that they have. The result of this study is α-Sutte Indicator is more appropriate in forecasting data unemployment insurance claim in IOWA. The accuracy level of α-Sutte Indicator is better if it is compared to any other methods.

Keywords: Forecasting, unemployment insurance claimants, α-Sutte Indicator, ARIMA

1 Introduction

The thing that becomes the main problem of a country is the high level of unemployment or no jobs. This problem makes every country feel confused to find the solution. The higher unemployment is caused by lots of age productive citizens who don't have a job. This is caused by the inappropriate competence that they have with the necessary competence. Besides, the high number of dropout becomes one of the causes of the high number of employment in a country.

The unemployment becomes the common matter from almost every area. The workers are labors from a company that have outsourcing status can possibly be fired because there is no clear working contract between the company and the labor. Outsourcing labor can also be fired at any time and of course different from permanent employee. Outsourcing labor doesn't have the right to receive pension allowance and other allowances.

According to Iqbal and Dad [1], Offshore outsourcing is a phenomenon that has been going for a long time and many multinational companies use this strategy to reduce operational costs. Outsourcing is a process of handover of one or more business process to outside vendors that are provided by the third parties to run the business process, for instance at cleaning service and security.

In big cities, most of the workers pick job insurance. In other words, this worker insurances himself/herself so that later on if he/she doesn't work so that they can claim the insurance. In big cities for example in IOWA United States, the worker who resigns from the job and has the ability to work, they can get temporary salary through Unemployment Insurance (UI) program. This UI program will give job seekers a payment to help them in covering living expenses temporarily while looking for a new job.

This UI program if it isn't managed well so that can affect the insurance company performance and can make the company loss. One of the ways to know the development of this insurance claim for each month is that by forecasting the people who are interested in this insurance. By the existence of the data forecasting result, the insurance company can form a plan and make a decision towards the issue in the future. The method that is often used in forecasting i.e. ARIMA [2–5], ARIMA-AO [6], Holt-Winters [3], Neural Network Time Series [7, 8], α-Sutte Indicator [9], and other methods [10].

The forecasting about unemployment insurance has been researched by other academicians, for instance: Mandy conducts a research about unemployment insurance forecast towards Tennessee case study [11], Barnichon conducts a research about The Ins and Outs of forecasting unemployment based on labor force flows [12], and the last one by Huang who discusses about forecasting the US unemployment rate with job openings index, this research uses ARIMA, ARIMAX, and VAR method in its forecasting process [13].

α-Sutte Indicator

α-Sutte Indicator is a new forecasting method that is currently developed by using 4 previous data. The uses of previous data is intended to accommodate the unstable data movement. Thus, the formula of α-Sutte Indicator mathematically is as follows [4, 14]:

$$a_t = \frac{\alpha\left(\frac{\Delta x}{\frac{\alpha+\delta}{2}}\right) + \beta\left(\frac{\Delta y}{\frac{\beta+\alpha}{2}}\right) + \gamma\left(\frac{\Delta z}{\frac{\gamma+\beta}{2}}\right)}{3} \quad (1)$$

where:

$\delta = a_{t-4}$

$\alpha = a_{t-3}$

$\beta = a_{t-2}$

$\gamma = a_{t-1}$

$\Delta x = \alpha - \delta = a_{t-3} - a_{t-4}$

$\Delta y = \beta - \alpha = a_{t-2} - a_{t-3}$

$\Delta z = \gamma - \beta = a_{t-1} - a_{t-2}$

a_t = data at t time

a_{t-k} = data at $(t - k)$ time

2 Methods

This research uses ARIMA, NNETAR, Robus Exponensial Smooting, Theta Model, and α-Sutte Indicator forecasting method. The use of this method is intended to be compared the level of accuracy from various forecasting methods. To see the quality of the forecast, so that it will be used a comparison based on MSE score. The lower MSE Score, the better accuracy level that they have.

This research will use dataset unemployment insurance claim in IOWA, USA. This dataset is acquired from the website that is provided by Iowa Workforce Development - Labor Market Information Division [15]. This dataset consists of 221 data i.e. January 2000 – May 2018. In the process of data forecasting so that R Package will be used that is sutteForecastR and RcmdrPlugin.sutteForecastR [16–18].

3 Result and Discussion

In conducting the forecast, the first step that has to be done is by doing a data plotting to see the data characteristics.

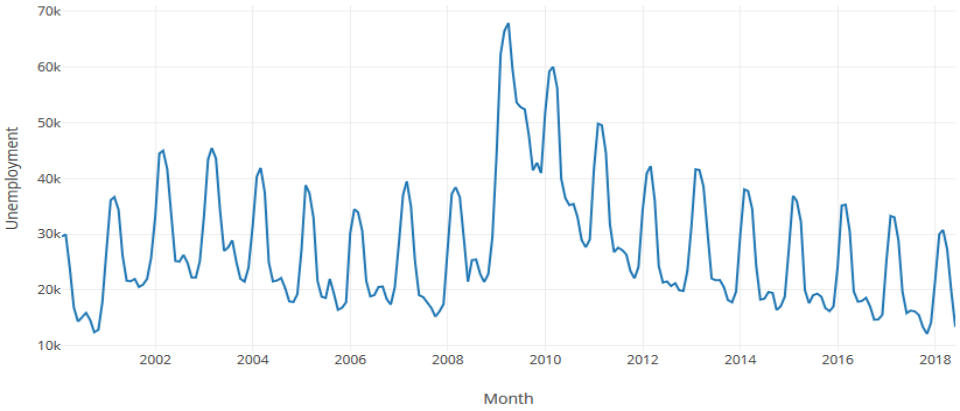

Fig. 1. Plotting data unemployment insurance claim in IOWA

In figure 1, it can be seen that the data is unstable (stationer) in its average or even its variance. In addition, it can be seen that the sudden increase of the unemployment data happens around 2009 - 2010.

After conducting the data plotting, the next step is data forecasting by using R Package i.e. sutteForecastR help. This package is R Package from α-Sutte Indicator method. sutteForecastR is R package which compare several forecasting methods i.e., α-Sutte Indicator, ARIMA, Holt-Winters, NNETAR, Robust Exponential Smooting, and Theta Model. Thus, the result is as follows.

```
> library(sutteForecastR)
> alpha.sutte(data3.ts)
$Tes_Data
[1] 14144 21765 30013 30802 27294 19957 13372

$Forecast_AlphaSutte
[1] 10841.09 13817.73 25177.79 37009.90 37335.17 29648.98 17058.78

$Forecast_AutoARIMA
    Point Forecast     Lo 80    Hi 80     Lo 95    Hi 95
215       14602.75 10406.426 18799.08 8185.0242 21020.48
216       19813.94 12239.414 27388.48 8229.6997 31398.19
217       24126.93 13493.657 34760.21 7864.7405 40389.12
218       24966.10 12269.503 37662.70 5548.3292 44383.88
219       23094.99  9643.228 36546.76 2522.2932 43667.69
220       21534.68  7968.247 35101.11  786.6126 42282.74
221       22478.58  8890.035 36067.13 1696.6930 43260.47

$Forecast_HoltWinters
    Point Forecast      Lo 80    Hi 80       Lo 95     Hi 95
215          10859   4175.339 17542.66     637.2225  21080.78
216           9607  -5338.120 24552.12  -13249.5894  32463.59
```

```
217        8355 -16652.970 33362.97  -29891.3893  46601.39
218        7103 -29504.919 43710.92  -48883.9812  63089.98
219        5851 -43716.357 55418.36  -69955.7309  81657.73
220        4599 -59159.063 68357.06  -92910.5428 102108.54
221        3347 -75735.144 82429.14 -117598.7026 124292.70

$Forecast_NNETAR
   Point Forecast
215       14276.26
216       23856.43
217       32637.93
218       34066.50
219       31116.34
220       23586.88
221       18517.00

$Forecast_Robust_exponential_smoothing
   Point Forecast     Lo 80    Hi 80      Lo 95    Hi 95
215     11251.067 8860.0440 13642.09  7594.3130 14907.82
216     10389.391 7111.1396 13667.64  5375.7381 15403.04
217      9527.715 5633.4734 13421.96  3571.9861 15483.44
218      8666.040 4304.9774 13027.10  1996.3704 15335.71
219      7804.364 3076.0474 12532.68   573.0276 15035.70
220      6942.689 1919.7576 11965.62  -739.2215 14624.60
221      6081.013  818.9408 11343.09 -1966.6319 14128.66

$Forecast_Theta
   Point Forecast     Lo 80    Hi 80      Lo 95    Hi 95
215      12105.72  4988.1263 19223.31   1220.302 22991.13
216      12100.31  2035.0193 22165.60  -3293.223 27493.84
217      12094.90  -232.3053 24422.11  -6757.934 30947.74
218      12089.49 -2144.6200 26323.61  -9679.704 33858.69
219      12084.09 -3830.0574 27998.23 -12254.496 36422.67
220      12078.68 -5354.3343 29511.69 -14582.813 38740.17
221      12073.27 -6756.4904 30903.03 -16724.363 40870.90

$AutoARIMA
Series: al_mi_10
ARIMA(3,0,3) with non-zero mean

Coefficients:
         ar1      ar2     ar3      ma1     ma2     ma3       mean
      1.7561  -1.6458  0.7203  -0.2534  0.7853  0.2832  27674.463
s.e.  0.0642   0.0856  0.0589   0.0847  0.0480  0.0782   2308.836

sigma^2 estimated as 10721757:  log likelihood=-2035.73
AIC=4087.46   AICc=4088.16   BIC=4114.38
```

$HoltWinters
Holt-Winters exponential smoothing with trend and without seasonal component.

Call:
HoltWinters(x = al_mi_10, gamma = FALSE)

Smoothing parameters:
 alpha: 1
 beta : 1
 gamma: FALSE

Coefficients:
   [,1]
a 12111
b -1252

$NNETAR
Series: al_mi_10
Model: NNAR(13,7)
Call: nnetar(y = al_mi_10)

Average of 20 networks, each of which is
a 13-7-1 network with 106 weights
options were - linear output units

sigma^2 estimated as 491972

$Robust_exponential_smoothing
ROBETS(M,A,N)

Call:
 robets(y = al_mi_10)

  Smoothing parameters:
    alpha = 0.9956
    beta = 0.0021

  Initial states:
    sigma = 0.1833
    l = 25060
    b = -1309

  sigma: 0.2253

  robAIC robAICc   robBIC
4675.355 4675.412 4682.087

$Theta_Model

Theta

Call:
 forecast::ets(y = y, model = "ANN", opt.crit = "mse")

 Smoothing parameters:
  alpha = 0.9999

 Initial states:
  l = 20421.7235

 sigma: 5553.885

    AIC   AICc   BIC
4842.634 4842.748 4852.732

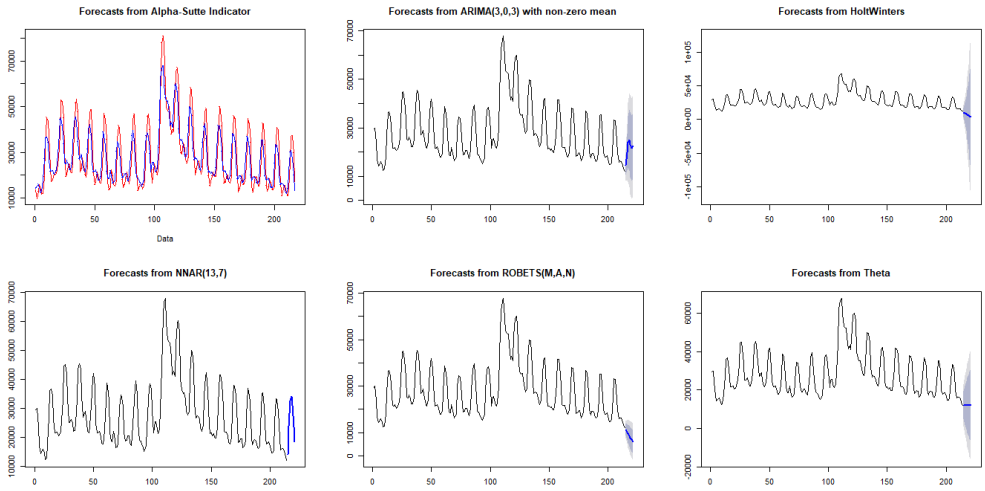

Fig. 2. Output Result of sutteForecastR

From the output result of sutteForecastR, it can be seen that the acquired model for unemployment insurance claim forecasting i.e. ARIMA(3,0,3) with non-zero mean; HoltWinters(α=1, β=1); NNAR(13,7); ROBETS(M,A,N); Theta (α=0.9999). Therefore, the comparison result of accuracy level of this forecasting method is displayed on table 1.

Table 1. The comparison of Forecasting Accuracy Level from Various Forecasting Methods

Metode	**Mean Squared Error (MSE)**
α-Sutte Indicator	4708563,194
ARIMA(3,0,3) with non-zero mean	75761678,297
Holt-Winters(α=1, β=1)	250262050,138
NNAR(13,7)	289303209,136

Metode	Mean Squared Error (MSE)
ROBETS(M, A, N)	220646298,135
Theta (α=0.9999)	96594696,765

From the table 1, it can be seen that α-Sutte Indicator method has higher accuracy than other methods; this can be seen from the MSE score from MSE and from α-Sutte Indicator that is smaller than any other methods. If it is based on accuracy level, the forecasting method that has the best accuracy simultaneously is α-Sutte Indicator; ARIMA(3,0,3) with non-zero mean; Theta (α=0.9999); ROBETS(M,A,N); HoltWinters(α=1, β=1); NNAR(13,7). The forecasting result from various forecasting methods can be seen in picture 3.

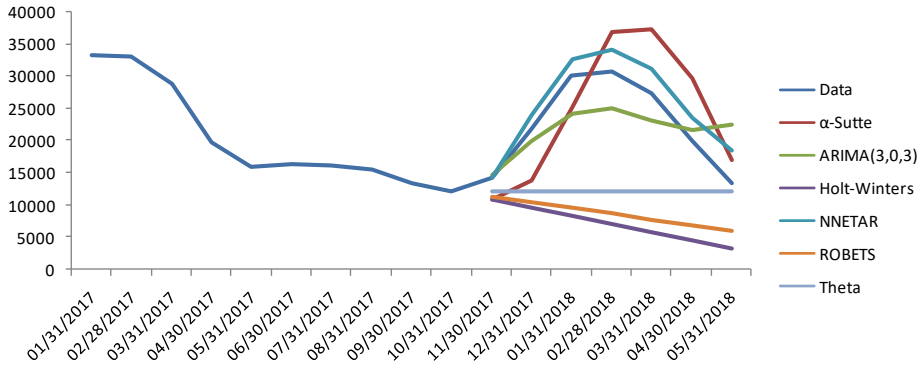

Fig. 3. The Comparison of Forecasting Result from Various Forecasting Methods

4 Conclusion

Dataset unemployment insurance claim in IOWA is a dataset that has unpredictable fluctuation level and of course, in forecasting it needs the appropriate method. Based on the result that is acquired by doing the forecasting using various forecasting methods, it is known that α-Sutte Indicator is more appropriate in forecasting data unemployment insurance claim in IOWA. The accuracy level of α-Sutte Indicator is better if it is compared to any other methods.

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