

1: Univariate Time Series

Time Series and Panels

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class: center, middle

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Nevertheless, they have important uses. For example, consider the hypothesis that Alex Jones's importance covaries with attention to Donald Trump.

```
ajgoogle <- read.csv("C:/Users/jnsno/OneDrive - Northwestern
```

```
ajgoogle
```

##	X.1	X	month	alexjones	donaldtrump	trumpapproval
## 1	1	1	2015-01	3	1	NA
## 2	2	2	2015-02	3	0	NA
## 3	3	3	2015-03	3	0	NA
## 4	4	4	2015-04	0	0	NA
## 5	5	5	2015-05	5	0	NA
## 6	6	6	2015-06	3	4	NA
## 7	7	7	2015-07	4	10	NA
## 8	8	8	2015-08	3	14	NA
## 9	9	9	2015-09	5	11	NA
## 10	10	10	2015-10	2	7	NA
## 11	11	11	2015-11	0	8	NA
## 12	12	12	2015-12	9	14	NA
## 13	13	13	2016-01	6	14	NA
## 14	14	14	2016-02	5	24	NA
## 15	15	15	2016-03	3	42	NA

```
library(lubridate)
```

```
## Loading required package: timechange
```

```
##
```

```
## Attaching package: 'lubridate'
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
##      date, intersect, setdiff, union
```

```
ym(ajgoogle$month)
```

```
## [1] "2015-01-01" "2015-02-01" "2015-03-01" "2015-04-01"
```

```
## [6] "2015-06-01" "2015-07-01" "2015-08-01" "2015-09-01"
```

```
## [11] "2015-11-01" "2015-12-01" "2016-01-01" "2016-02-01"
```

```
## [16] "2016-04-01" "2016-05-01" "2016-06-01" "2016-07-01"
```

```
## [21] "2016-09-01" "2016-10-01" "2016-11-01" "2016-12-01"
```

```
## [26] "2017-02-01" "2017-03-01" "2017-04-01" "2017-05-01"
```

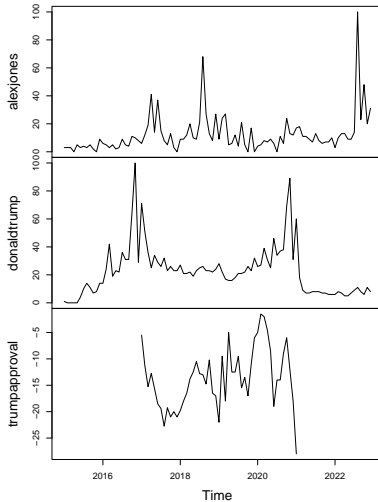
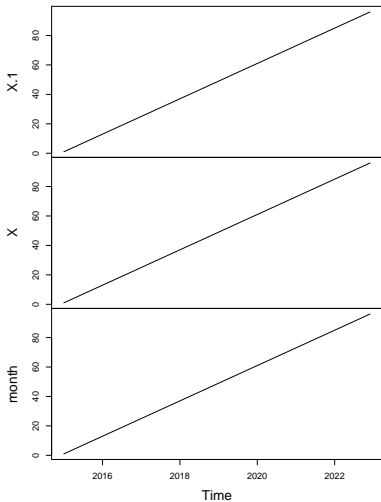
```
## [31] "2017-07-01" "2017-08-01" "2017-09-01" "2017-10-01"
```

```
## [36] "2017-12-01" "2018-01-01" "2018-02-01" "2018-03-01"
```

```
## [41] "2018-05-01" "2018-06-01" "2018-07-01" "2018-08-01"
```

```
ajgoogle.ts <- ts(ajgoogle, start=2015, frequency=12)  
plot.ts(ajgoogle.ts)
```

ajgoogle.ts



```
naive_aj_regression <- lm(alexjones ~ donaldtrump + trumpapproval)

summary(naive_aj_regression)
```

```
##
```

```
## Call:
```

```
## lm(formula = alexjones ~ donaldtrump + trumpapproval, data = data)
```

```
##
```

```
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max
## -14.995  -6.838  -2.959   4.030  54.661
```

```
##
```

```
## Coefficients:
```

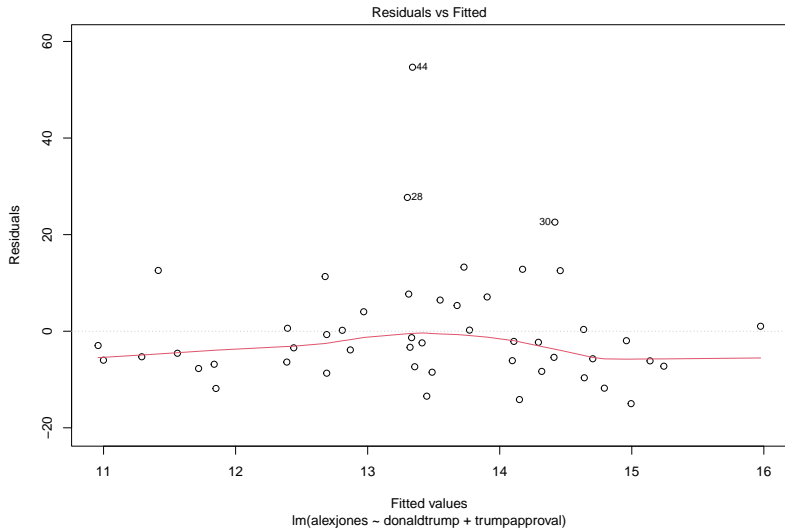
```
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   11.01418     6.14478   1.792   0.0796 .
## donaldtrump   -0.01181     0.12082  -0.098   0.9226
## trumpapproval -0.20249     0.31022  -0.653   0.5172
```

```
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1
```

```
##
```

```
plot(naive_aj_regression, 1)
```



Autoregression

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \cdots + \phi_p y_{t-p} + a_t$$

$$-1 \leq \phi_k \leq 1$$