TV Channel Models

Organic Channel

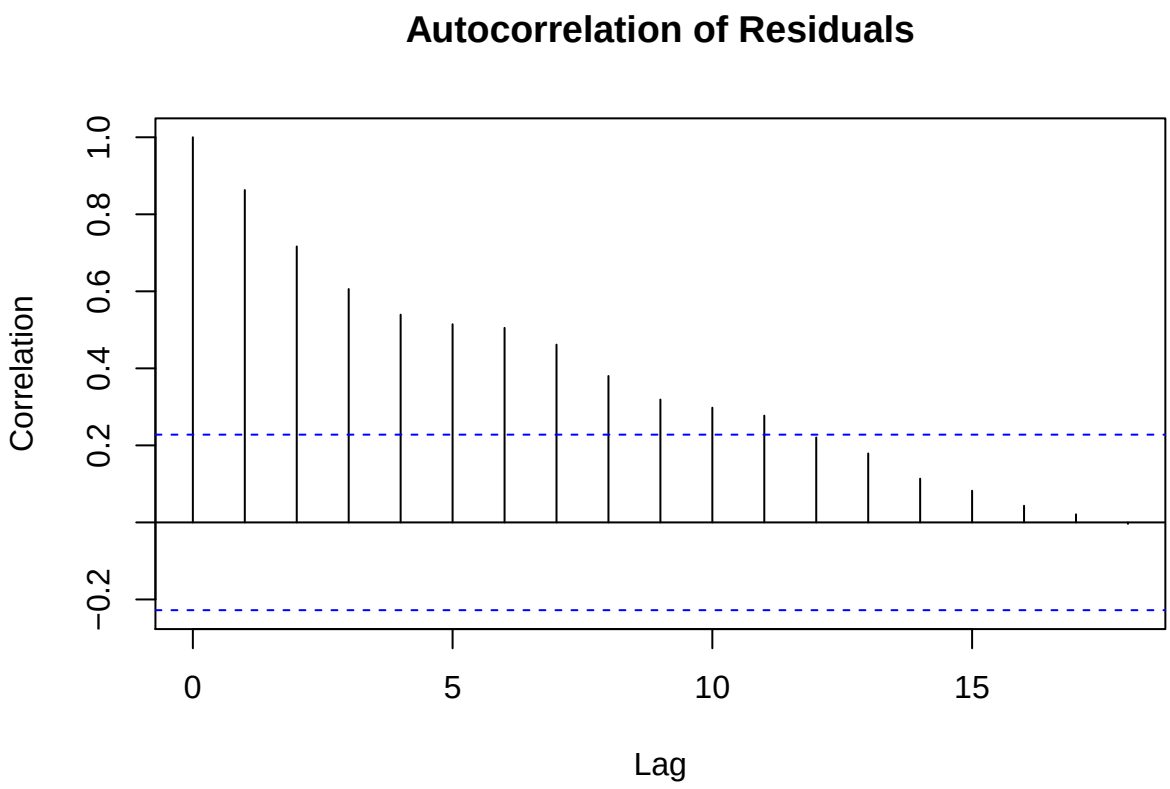
2nd order polynomial fit

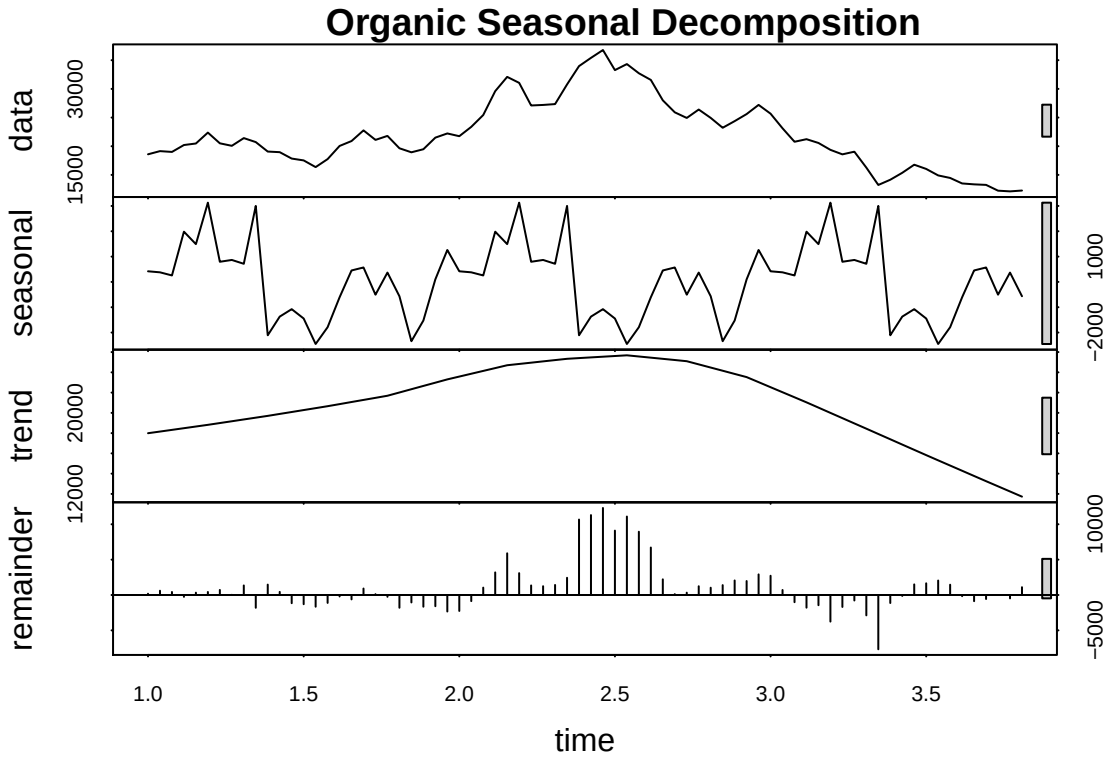
```
##               round.coef.poly_fit...3.
## (Intercept)               1.716091e+04
## tv.spend                  7.500000e-02
## I(tv.spend^2)             0.000000e+00
## R2                        6.040128e-01
```

Stepwise polynomial fit

```
##             round.coef.stepwise_model...3.
## (Intercept)                    1.710471e+04
## tv.spend                       7.700000e-02
## R2                             6.039495e-01
```

Model diagnostics show strong autocorrelation in the data and evidence of seasonality. This suggests we build a model using the same tv spending coefficients isolating temporal factors.

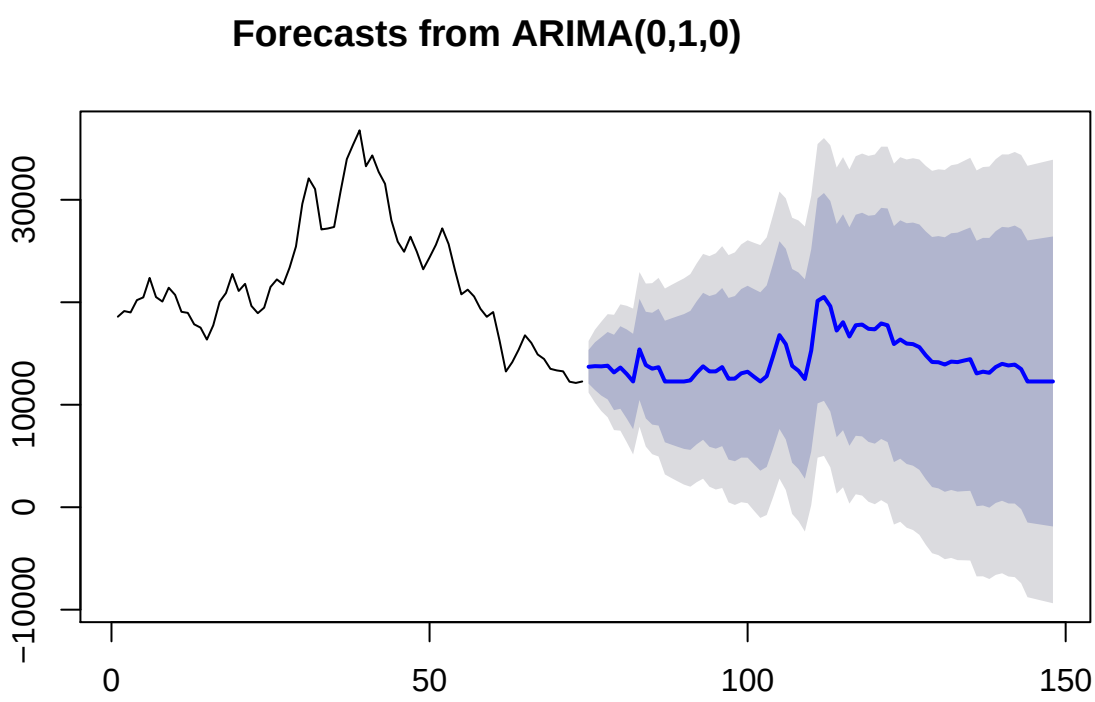





```
## numeric(0)
```

Arima model with TV spend

```
## Series: sub_study$organic
## ARIMA(0,1,0)
##
## Coefficients:
##       xreg_matrix
##            0.0334
## s.e.       0.0047
##
## sigma^2 estimated as 1647339:  log likelihood=-626.07
## AIC=1256.14   AICc=1256.31   BIC=1260.72
##
## Training set error measures:
##                      ME     RMSE      MAE        MPE     MAPE      MASE
## Training set -65.81154 1274.787 1038.084 -0.4895349 4.843873 0.7586055
##                   ACF1
## Training set 0.228156
```




```
##             coef.tv_arima.
## xreg_matrix     0.03343641
## R2              0.96000000

##        1        2        3        4        5        6        7        8
## 20394.24 20532.70 20483.98 20631.14 19146.64 20231.16 18796.58 17160.91
##        9       10       11       12       13       14       15       16
## 24273.66 20769.31 19975.47 20304.31 17160.91 17160.91 17160.91 17160.91
##       17       18       19       20       21       22       23       24
## 17400.64 19069.98 20498.40 19369.81 19376.08 20328.19 17761.40 17783.23
##       25       26       27       28       29       30       31       32
## 18950.36 19301.69 18201.08 17160.91 18325.08 22741.43 27508.61 25463.92
##       33       34       35       36       37       38       39       40
## 20600.85 19516.31 17702.80 24019.59 35408.07 36329.13 34154.22 28534.68
##       41       42       43       44       45       46       47       48
## 30451.39 27177.92 29757.91 29915.46 28937.78 28819.12 30175.46 29747.61
##       49       50       51       52       53       54       55       56
## 25474.45 26504.24 25580.62 25457.19 24778.21 22959.85 21450.46 21402.48
##       57       58       59       60       61       62       63       64
## 20887.79 21542.86 21428.30 21768.72 22087.75 18927.36 19311.58 19067.41
##       65       66       67       68       69       70       71       72
## 20332.59 21046.28 20685.12 20883.00 19884.34 17160.91 17160.91 17160.91
##       73       74
## 17160.91 17160.91

##        1        2        3        4        5        6        7        8
```

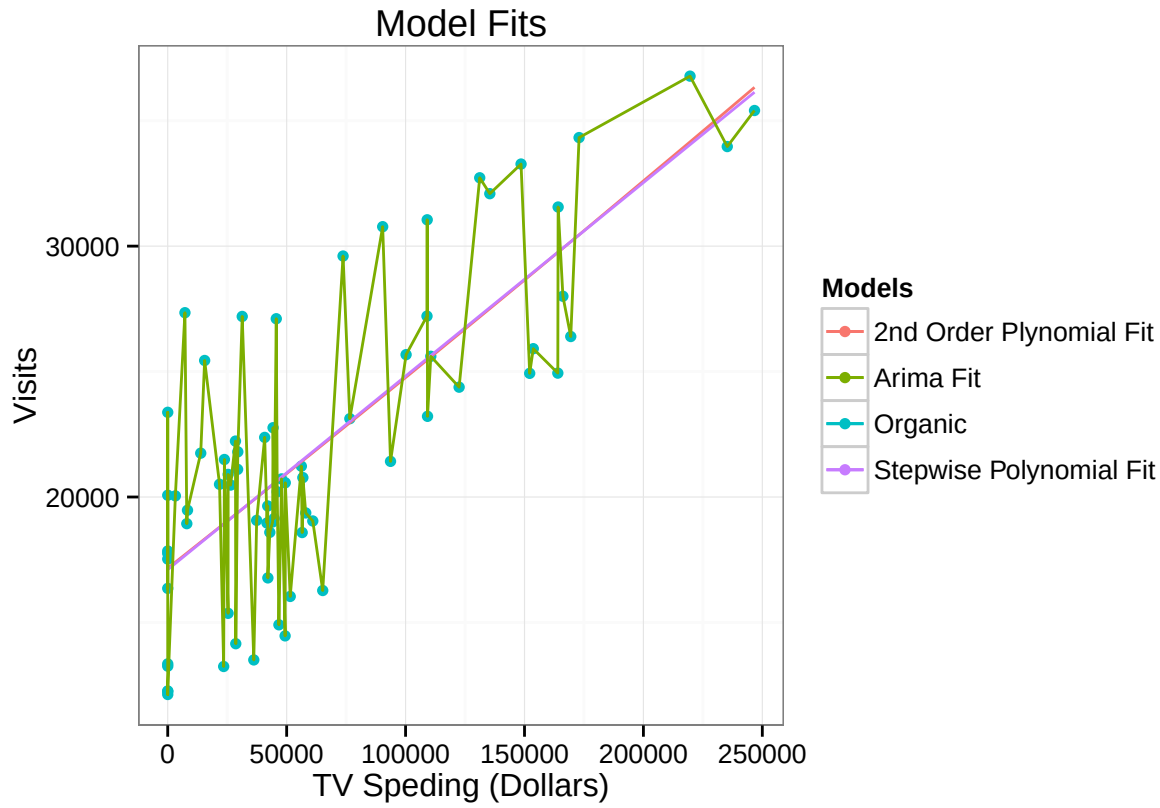
```
## 20414.81 20555.59 20506.06 20655.64 19142.71 20248.88 18784.63 17104.70
##        9       10       11       12       13       14       15       16
## 24330.35 20796.00 19988.53 20323.32 17104.70 17104.70 17104.70 17104.70
##       17       18       19       20       21       22       23       24
## 17351.63 19064.34 20520.72 19370.73 19377.14 20347.62 17722.74 17745.19
##       25       26       27       28       29       30       31       32
## 18942.00 19301.15 18174.31 17104.70 18301.52 22790.99 27550.60 25519.85
##       33       34       35       36       37       38       39       40
## 20624.86 19520.31 17662.50 24075.74 35252.30 36136.01 34044.62 28563.75
##       41       42       43       44       45       46       47       48
## 30445.94 27223.23 29766.50 29921.01 28960.71 28843.92 30175.80 29756.39
##       49       50       51       52       53       54       55       56
## 25530.34 26555.06 25636.18 25513.14 24835.25 23010.99 21486.81 21438.21
##       57       58       59       60       61       62       63       64
## 20916.29 21580.38 21464.36 21808.94 22131.45 18918.47 19311.26 19061.72
##       65       66       67       68       69       70       71       72
## 20352.09 21077.12 20710.48 20911.43 19895.66 17104.70 17104.70 17104.70
##       73       74
## 17104.70 17104.70
```

```
## Time Series:
## Start = 1
## End = 74
## Frequency = 1
##  [1] 18573.84 18652.02 19120.53 19069.83 19552.21 20954.48 21741.31
##  [8] 19778.82 23202.01 19888.01 20371.00 19213.12 17568.87 17847.00
## [15] 17526.00 16357.00 17858.03 20787.39 21531.28 22263.53 21103.78
## [22] 22221.66 18504.23 18946.73 19991.77 21650.68 21739.56 21283.37
## [29] 23894.77 27387.99 31668.09 31210.76 28928.23 26627.22 26391.72
## [36] 30125.87 35619.57 34352.05 34499.47 34400.28 34087.85 32930.09
## [43] 33827.40 31625.97 27585.75 25861.38 25506.31 26215.21 23106.19
## [50] 23660.17 23979.71 25554.67 26916.16 24884.26 22462.33 20752.94
## [57] 21001.77 20854.85 19314.71 18732.36 19183.80 14879.31 13414.26
## [64] 14043.83 15923.32 17089.27 15877.08 14993.10 14023.71 12296.24
## [71] 13348.00 13257.00 12247.00 12128.00
```

```
##  [1] 18591 19142 19005 20208 20475 22376 20507 20070 21420 20721 19068
## [12] 18964 17847 17526 16357 17751 20045 20900 22762 21101 21801 19642
## [23] 18937 19473 21495 22228 21747 23376 25442 29605 32091 31050 27106
## [34] 27197 27346 30775 33969 35406 36776 33272 34327 32725 31559 28002
## [45] 25912 24929 26397 24938 23216 24378 25608 27210 25675 23123 20774
## [56] 21228 20567 19365 18583 19044 16272 13244 14152 15364 16775 16036
## [67] 14906 14464 13506 13348 13257 12247 12128 12269
```

```
##  [1]  42911.00  44736.00  44094.00  46033.00  26420.00  40760.00  21778.00
##  [8]      0.00  93670.66  47852.64  37384.87  41724.99      0.00      0.00
## [15]      0.00      0.00   3201.00  25404.00  44284.00  29376.00  29459.00
## [22]  42040.00   8012.00   8303.00  23818.00  28474.00  13866.00      0.00
## [29]  15515.15  73715.00 135416.85 109091.00  45634.00  31315.00   7231.00
## [36]  90370.00 235259.00 246715.00 219603.00 148551.00 172951.00 131173.00
## [43] 164143.00 166146.00 153697.00 152183.00 169449.00 164012.00 109227.00
## [50] 122511.00 110599.00 109004.00 100216.00  76567.00  56808.00  56178.00
## [57]  49412.00  58021.00  56517.00  60984.00  65165.00  23513.00  28605.00
```

```
## [64]  25370.00  42098.00  51497.00  46744.00  49349.00  36181.00      0.00
## [71]      0.00      0.00      0.00      0.00
```



Organic Home Channel

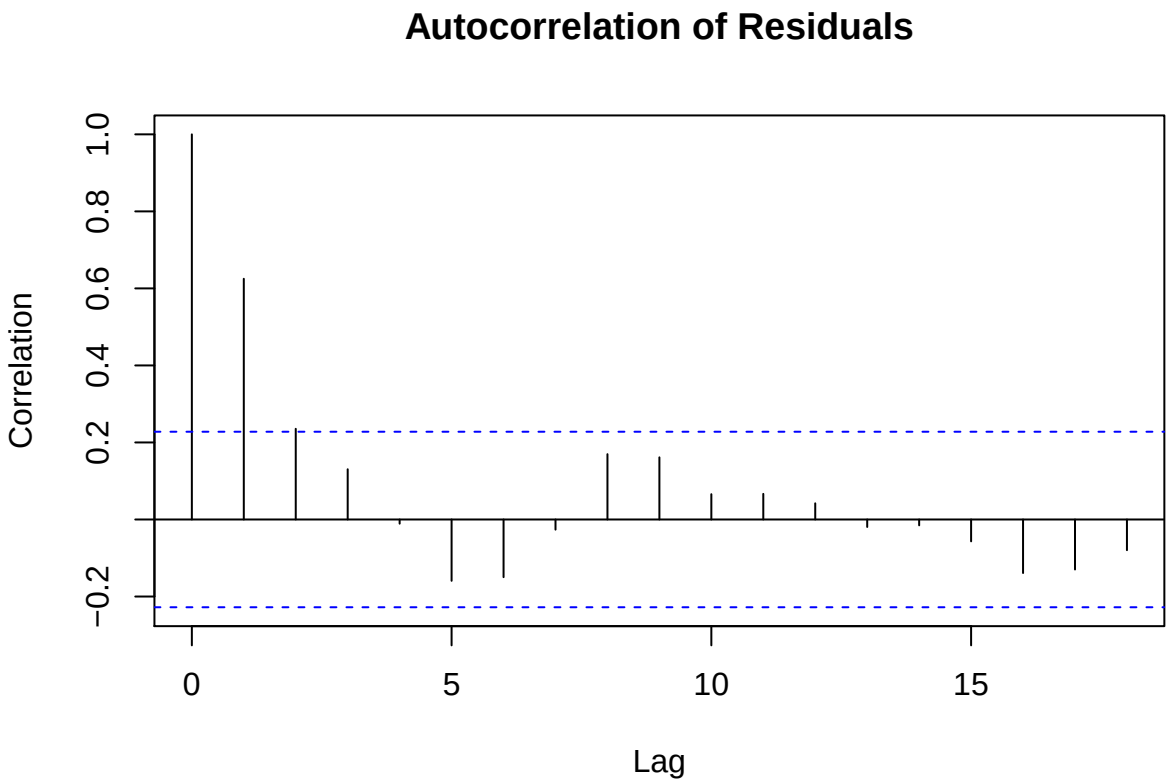
2nd order polynomial fit

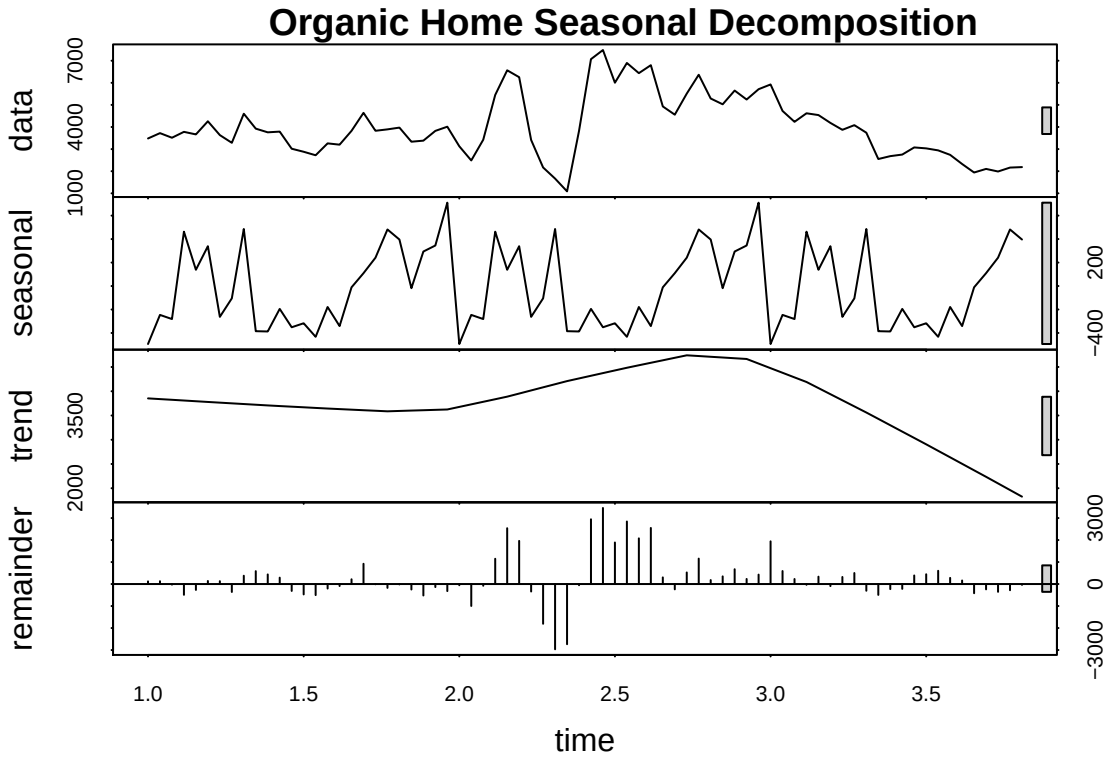
```
##                round.coef.poly_fit...3.
## (Intercept)                2526.6750000
## tv.spend                      0.0310000
## I(tv.spend^2)                 0.0000000
## R2                            0.6614353
```

Stepwise polynomial fit

```
##                round.coef.stepwise_model...3.
## (Intercept)                       2584.3580000
## tv.spend                             0.0260000
## I(tv.spend^3)                        0.0000000
## R2                                   0.6656734
```

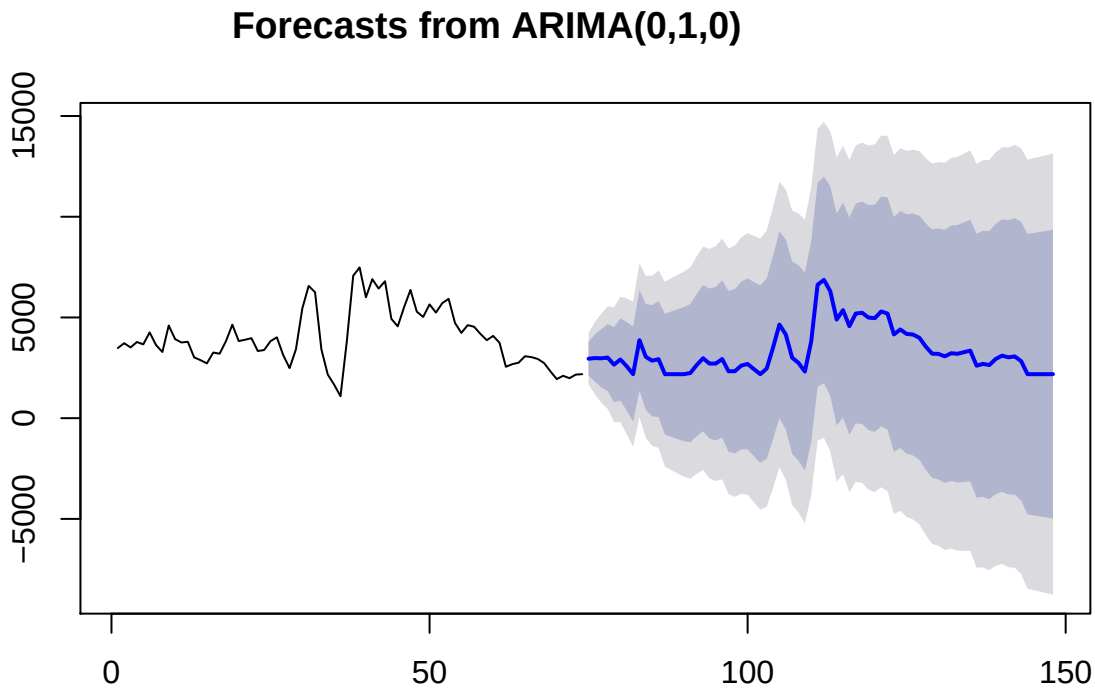
Model diagnostics show strong autocorrelation in the data and evidence of seasonality. This suggests we build a model using the same tv spending coefficients isolating temporal factors.


Autocorrelation of Residuals
Correlation
1.0
0.8
0.6
0.4
0.2
−0.2
0
5
10
15
Lag


Organic Home Seasonal Decomposition
data
seasonal
trend
remainder
1000
4000
7000
2000
3500
200
−400
3000
0
−3000
1.0
1.5
2.0
2.5
3.0
3.5
time

```
## numeric(0)
```

Arima model with TV spend




```
##                coef.tv_arima.
## tv.spend         1.783492e-02
## I(tv.spend^3)    1.863520e-14
## R2               7.900000e-01
```

Direct Home Channel

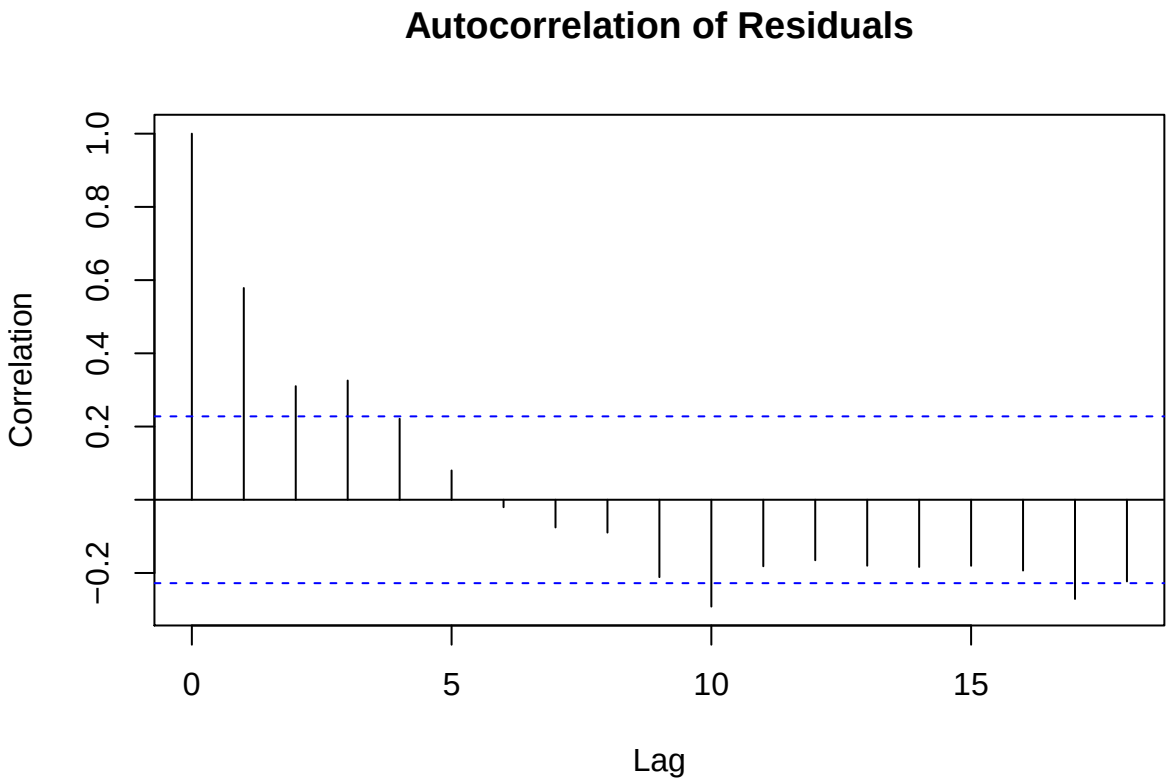
2nd order polynomial fit

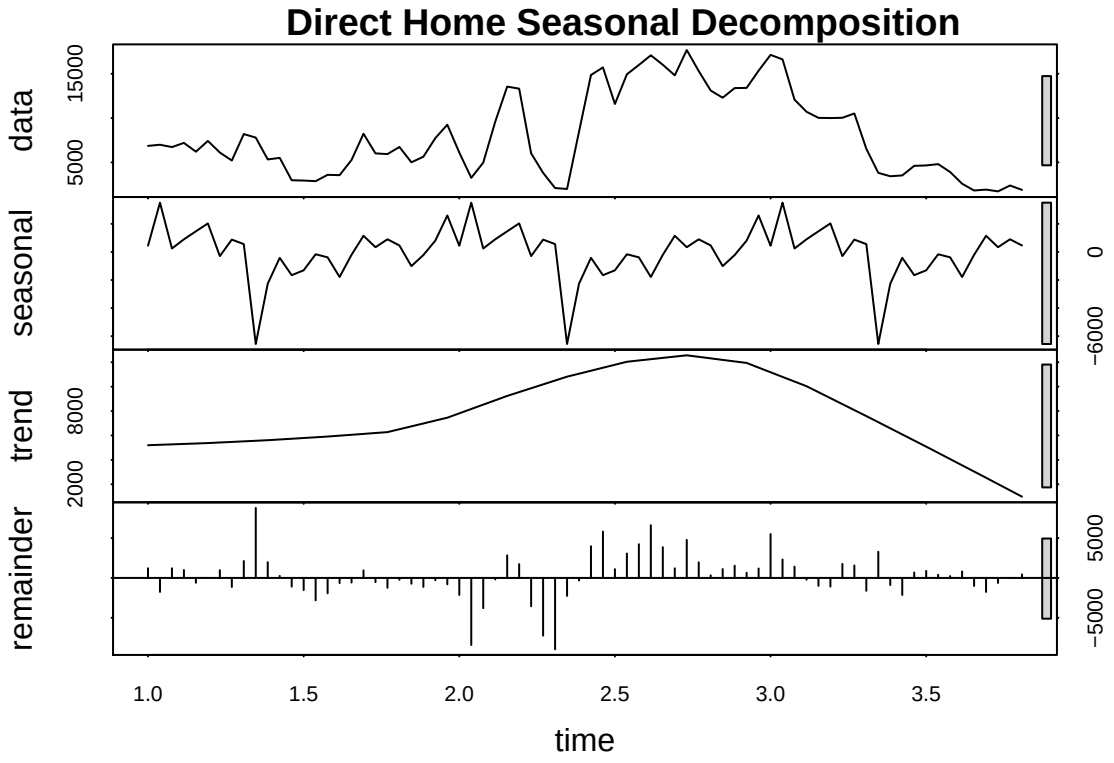
```
##                round.coef.poly_fit...3.
## (Intercept)               2389.3570000
## tv.spend                     0.1310000
## I(tv.spend^2)                0.0000000
## R2                           0.7465269
```

Stepwise polynomial fit

```
##                round.coef.stepwise_model...3.
## (Intercept)                      2711.9240000
## tv.spend                            0.1040000
## I(tv.spend^3)                       0.0000000
## R2                                  0.7567091
```

Model diagnostics show strong very little autocorrelation in the data nor seasonality.






```
## numeric(0)
```

Paid Brand Channel

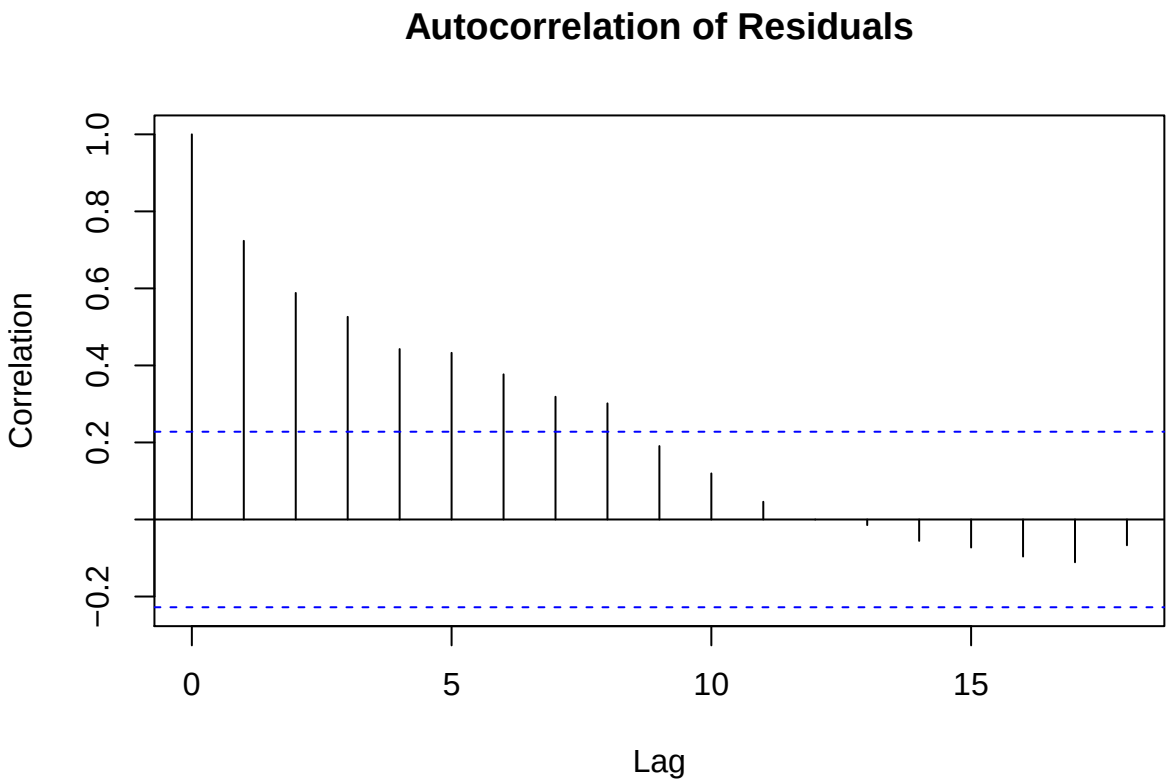
2nd order polynomial fit

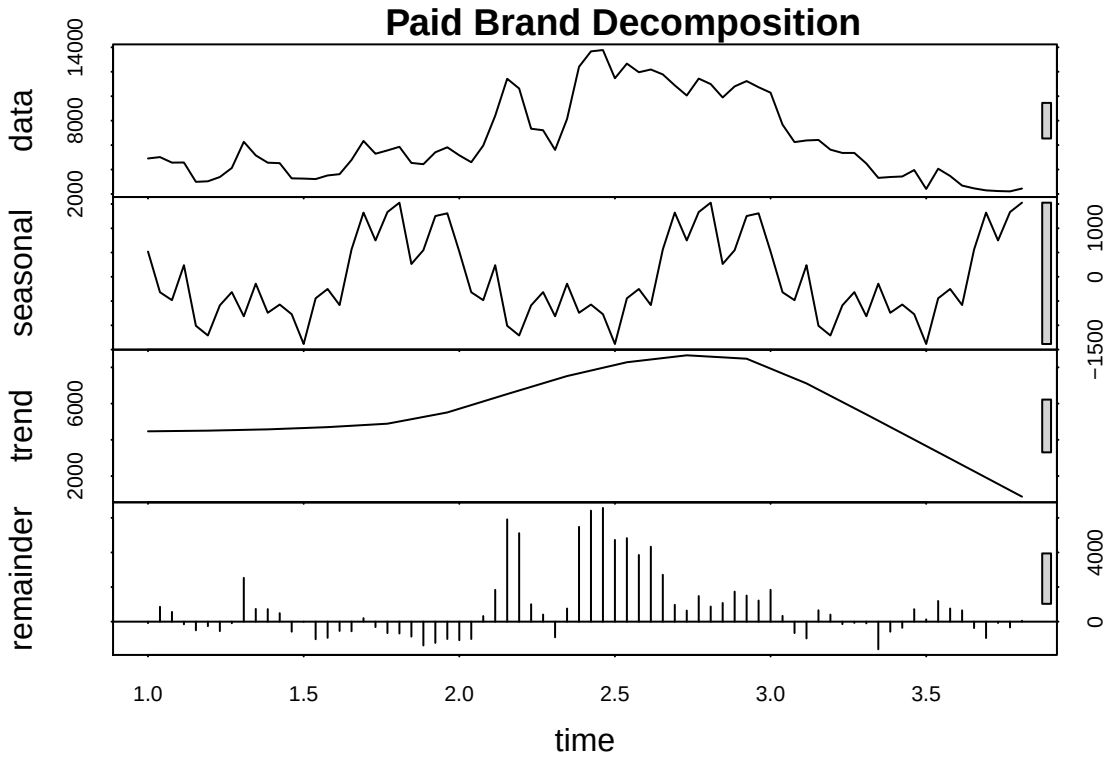
```
##                round.coef.poly_fit...3.
## (Intercept)               2871.9510000
## tv.spend                     0.0650000
## I(tv.spend^2)                0.0000000
## R2                           0.8523123
```

Stepwise polynomial fit

```
##                round.coef.stepwise_model...3.
## (Intercept)                     3500.7240000
## I(tv.spend^2)                      0.0000000
## I(tv.spend^3)                      0.0000000
## I(tv.spend^4)                      0.0000000
## R2                                 0.8756773
```

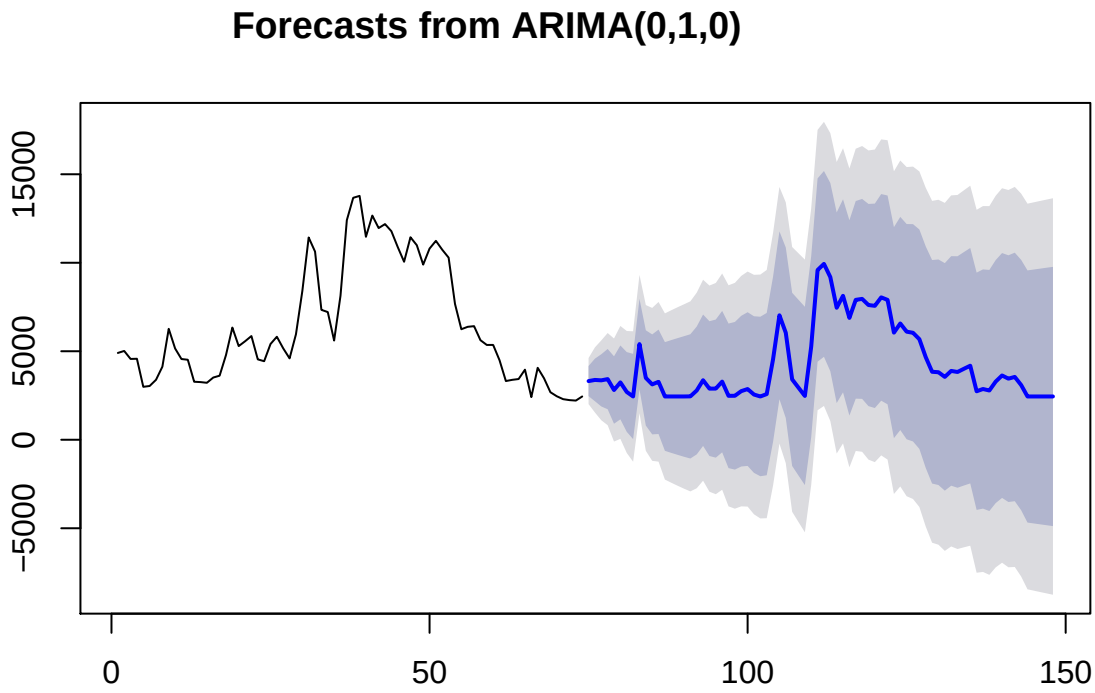
Model diagnostics show strong autocorrelation in the data and evidence of seasonality. This suggests we build a model using the same tv spending coefficients isolating temporal factors.


Autocorrelation of Residuals
Correlation
1.0
0.8
0.6
0.4
0.2
−0.2
0
5
10
15
Lag


Paid Brand Decomposition
data
seasonal
trend
remainder
2000
8000
14000
2000
6000
−1500
0
1000
0
4000
1.0
1.5
2.0
2.5
3.0
3.5
time

```
## numeric(0)
```

Arima model with TV spend




```
##                coef.tv_arima.
## I(tv.spend^2)    6.115620e-07
## I(tv.spend^3)   -3.507602e-12
## I(tv.spend^4)    6.191551e-18
## R2               9.600000e-01
```