

# 2018FcastUniv

January 30, 2018

2018 Alabama Residential Forecast Alabama Center For Real Estate

## 1 Summary (methodology)

The projections for 2018 were based on using a ratio of the 4th quarter's actual sales for each year and linear regression against full year sales, with as much good history as we have in our database.

We have produced a forecast for 29 areas. We have anywhere from 6 to 13 years of historical data depending on the area. The areas are quite different in total annual volume, ranging from under 100 sales per year to over 40,000 sales per year for the total Statewide data. Generally, the more annual sales and the greater history we have the greater projection accuracy we have achieved in the past.

In short, the larger the market the more likely the projections will be more accurate. This is due to both the law of large numbers and the momentum of larger markets. Using the last quarters of the year, we believe is the most relevant and timely data to project the following year. It also allows us to avoid more volatile periods of the year.

To the extent that events happen during the year, natural such as major storm disasters, or economic such as quick onset recessions, this approach to forecasting cannot not project that possibility (up or down). Likewise, unusual activity in the 4th quarter in a particular market could distort the projections.

Some areas and time periods have adjustments applied to history to normalize the numbers. Examples include the tax credit in 2009 that pulled sales into 2009 and out of 2010. We also see limited data in particular for Baldwin county. Baldwin Condo have had 4q 2013 sales reduced by 65 units, due to an abnormal volume of 2013 year end closings. Certain areas have unusual events, such as plant closing or openings as well as major weather events that may distort historical data and certainly could happen in the future.

We found some areas, specifically Talladega have changed the basis they use to report sales thus invalidating the projection. We suspect that others including Huntsville, which redefined a number of MLS areas, including Cherokee cty, Jackson cty, Athens and Marshall, redefined areas in some way, invalidating the projections.

As usual we can't say that past performance is indicative of future results. It does however represent an informed guess.

We think the projections have value, if for no other reason than to see if the year is unfolding as predicted or if variances emerge that should be investigated. So, please take these projections as our best efforts, but do your own work.

## 2 Statewide full year 2018 forecast summary

/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/frame.py:2746: SettingWithCopyWarning  
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/indexing.html#>  
    \*\*kwargs)

/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:337: SettingWithCopyWarning  
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Try using .loc[row\_indexer,col\_indexer] = value instead

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    self.obj[key] = \_infer\_fill\_value(value)

/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:601: SettingWithCopyWarning  
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    self.obj[item\_labels[indexer[info\_axis]]] = value

/home/tom/anaconda3/lib/python3.6/site-packages/ipykernel/\_main\_.py:181: SettingWithCopyWarning  
A value is trying to be set on a copy of a slice from a DataFrame.

Try using .loc[row\_indexer,col\_indexer] = value instead

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/indexing.html#>

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    self.obj[item\_labels[indexer[info\_axis]]] = value

Statewide projected 2018 = 57,762, 0.33% difference from 2017 actual of = 57,571

Athens projected 2018 = 1,931, 13.59% difference from 2017 actual of = 1,700

Baldwin\_County projected 2018 = 6,593, 0.47% difference from 2017 actual of = 6,562

Baldwin\_Condos projected 2018 = 1,556, -12.63% difference from 2017 actual of = 1,781  
 Birmingham projected 2018 = 15,366, 3.02% difference from 2017 actual of = 14,915  
 Calhoun projected 2018 = 1,669, 1.4% difference from 2017 actual of = 1,646  
 Cherokee projected 2018 = 279, 16.25% difference from 2017 actual of = 240  
 Covington projected 2018 = 321, 15.05% difference from 2017 actual of = 279  
 Cullman projected 2018 = 1,011, 18.66% difference from 2017 actual of = 852  
 Dothan projected 2018 = 1,431, 4.0% difference from 2017 actual of = 1,376  
 Gadsden projected 2018 = 927, 3.46% difference from 2017 actual of = 896  
 Huntsville projected 2018 = 7,212, 3.09% difference from 2017 actual of = 6,996  
 Jackson projected 2018 = 252, -2.33% difference from 2017 actual of = 258  
 Lake\_Martin projected 2018 = 684, 2.86% difference from 2017 actual of = 665  
 Lee projected 2018 = 2,035, 9.0% difference from 2017 actual of = 1,867  
 Marshall projected 2018 = 834, -4.36% difference from 2017 actual of = 872  
 Mobile projected 2018 = 4,598, 2.43% difference from 2017 actual of = 4,489  
 Monroe projected 2018 = 105, 10.53% difference from 2017 actual of = 95  
 Montgomery projected 2018 = 4,637, 5.39% difference from 2017 actual of = 4,400  
 Morgan projected 2018 = 1,432, -3.37% difference from 2017 actual of = 1,482  
 Shoals\_Area projected 2018 = 1,688, -2.03% difference from 2017 actual of = 1,723  
 Phenix\_City projected 2018 = 1,205, 5.89% difference from 2017 actual of = 1,138  
 Selma projected 2018 = 151, 22.76% difference from 2017 actual of = 123  
 Talladega projected 2018 = 449, -1.97% difference from 2017 actual of = 458  
 Tuscaloosa projected 2018 = 2,724, 5.17% difference from 2017 actual of = 2,590  
 Walker projected 2018 = 1,075, 20.65% difference from 2017 actual of = 891  
 Wiregrass projected 2018 = 1,043, -0.38% difference from 2017 actual of = 1,047  
 Lake\_Martin\_Waterfront projected 2018 = 346, -4.68% difference from 2017 actual of = 363

#### Statewide

	Units	fcast
2018-01-01	NaN	3411.0
2018-02-01	NaN	3892.0
2018-03-01	NaN	5008.0
2018-04-01	NaN	4991.0
2018-05-01	NaN	5629.0
2018-06-01	NaN	5830.0
2018-07-01	NaN	5611.0
2018-08-01	NaN	5538.0
2018-09-01	NaN	4873.0
2018-10-01	NaN	4564.0
2018-11-01	NaN	4138.0
2018-12-01	NaN	4277.0

#### Athens

	Units	fcast
2018-01-01	NaN	100.0
2018-02-01	NaN	123.0
2018-03-01	NaN	164.0
2018-04-01	NaN	156.0
2018-05-01	NaN	182.0

```
2018-06-01      NaN  178.0
2018-07-01      NaN  195.0
2018-08-01      NaN  177.0
2018-09-01      NaN  181.0
2018-10-01      NaN  161.0
2018-11-01      NaN  160.0
2018-12-01      NaN  154.0
```

Out[11]: 2

```
/iffalse This will only work if data is available for the new year (and I have not
run it in a long time) Monthly Fcast to actual charts area_tabs = [1]area_tabs =
list(map(str,range(1,28)))nrows = int(math.ceil(len(area_tabs)/2.))figlen = nrows *
7adjust the figure size height to be sized to the number of rows fig,axs = plt.subplots(nrows,2,sharey =
False,figsize = (25,7 * nrows))for ax,area_tabs in zip(axs.flat,area_tabs) :
    actdf,aname = get_data(area_tabs)dfform,fullYrs,lastq,fcast_yr,projections,yrahead,aname,actdf,merged2,mergederrs,montdist,
    do_projections(actdf,aname)mergedfcst.tail(13).fcast.plot(ax = ax,style ='r')lastyrtot =
    str(mergedfcst.tail(12)[['Units']].iloc[0])mergedfcst.tail(13).Units.plot(ax = ax,title ='Area :
    0 Forecast for 20161 vs. Actual 2016 of 2'.format(unicode(aname),unicode(mergedfcst['fcast'][-12 :
    -11].values),lastyrtot))mergedfcst.tail(12).plot(ax = ax,title = 'Area :
    0 Forecast for 20141 vs. Actual 2013 of 2'.format(unicode(aname),unicode(merged2['fcast'][-1 :
    ].values),lastyrtot))mergedfcst.tail(13)mergedfcst.tail(12).Units.plot()
```

### 3 Full year projections with history

This is useful to see how variable the history has been and how the forecasted linear regression tracks.

```
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See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/indexing.html#>  
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self.obj[key] = \_infer\_fill\_value(value)

```
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See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/indexing.html#>  
self.obj[item\_labels[indexer[info\_axis]]] = value



For more information contact Tom Brander ([tom@oswco.com](mailto:tom@oswco.com)) or Grayson Glaze

(gglaze@cba.ua.edu)

### 3.1 The cell below produces the monthly breakdown by area

```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/frame.py:2746: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame
```

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/indexing.html#>  
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A value is trying to be set on a copy of a slice from a DataFrame.
```

Try using .loc[row\_indexer,col\_indexer] = value instead

See the caveats in the documentation: <http://pandas.pydata.org/pandas-docs/stable/indexing.html#>  
self.obj[item\_labels[indexer[info\_axis]]] = value

'Area mergedfcast: Statewide'

'Area mergedfcast: Athens'

'Area mergedfcast: Baldwin\_County'

'Area mergedfcast: Baldwin\_Condos'

'Area mergedfcast: Birmingham'

'Area mergedfcast: Calhoun'

'Area mergedfcast: Cherokee'

'Area mergedfcast: Covington'

'Area mergedfcast: Cullman'

'Area mergedfcast: Dothan'

'Area mergedfcast: Gadsden'

'Area mergedfcast: Huntsville'

'Area mergedfcast: Jackson'

'Area mergedfcast: Lake\_Martin'

'Area mergedfcast: Lee'

'Area mergedfcast: Marshall'

'Area mergedfcast: Mobile'

'Area mergedfcast: Monroe'

'Area mergedfcast: Montgomery'

'Area mergedfcast: Morgan'

'Area mergedfcast: Shoals\_Area'

'Area mergedfcast: Phenix\_City'

'Area mergedfcast: Selma'

'Area mergedfcast: Talladega'

'Area mergedfcast: Tuscaloosa'

'Area mergedfcast: Walker'

'Area mergedfcast: Wiregrass'

'Area mergedfcast: Lake\_Martin\_Waterfront'

## The section below is used for statistical diagnostics

```
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A value is trying to be set on a copy of a slice from a DataFrame
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#  
    **kwargs)
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:337: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#  
    self.obj[key] = _infer_fill_value(value)
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:601: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#  
    self.obj[item_labels[indexer[info_axis]]] = value
```

```
'Area fcast summary: Statewide'
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis  
    "anyway, n=%i" % int(n))
```

```
'Area regress: Statewide'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.796
Model:                            OLS      Adj. R-squared:            0.783
Method:                          Least Squares      F-statistic:                 58.66
Date:                            Mon, 29 Jan 2018      Prob (F-statistic):        1.47e-06
Time:                           16:56:24      Log-Likelihood:            -163.28
No. Observations:                  17      AIC:                         330.6
Df Residuals:                      15      BIC:                         332.2
Df Model:                           1
Covariance Type:                nonrobust
=====

            coef      std err           t      P>|t|      [0.025      0.975]
-----
const    1.222e+04    4595.889     2.659      0.018    2425.105    2.2e+04
lastqu      3.4477       0.450      7.659      0.000       2.488     4.407
```

```
=====
Omnibus:                 2.559   Durbin-Watson:           1.593
Prob(Omnibus):          0.278   Jarque-Bera (JB):        0.852
Skew:                   -0.420   Prob(JB):                  0.653
Kurtosis:                3.706   Cond. No.            5.06e+04
=====
```

Warnings:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
[2] The condition number is large, 5.06e+04. This might indicate that there are  
strong multicollinearity or other numerical problems.

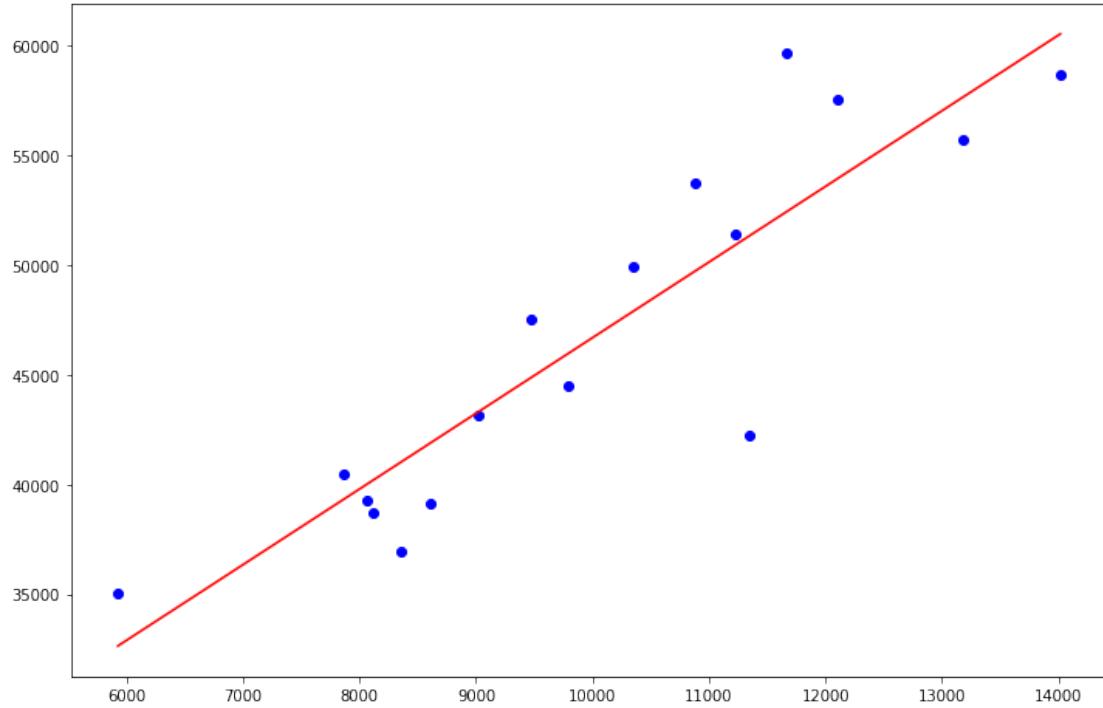
"""

'Area Historical errors on Fcast: Statewide'

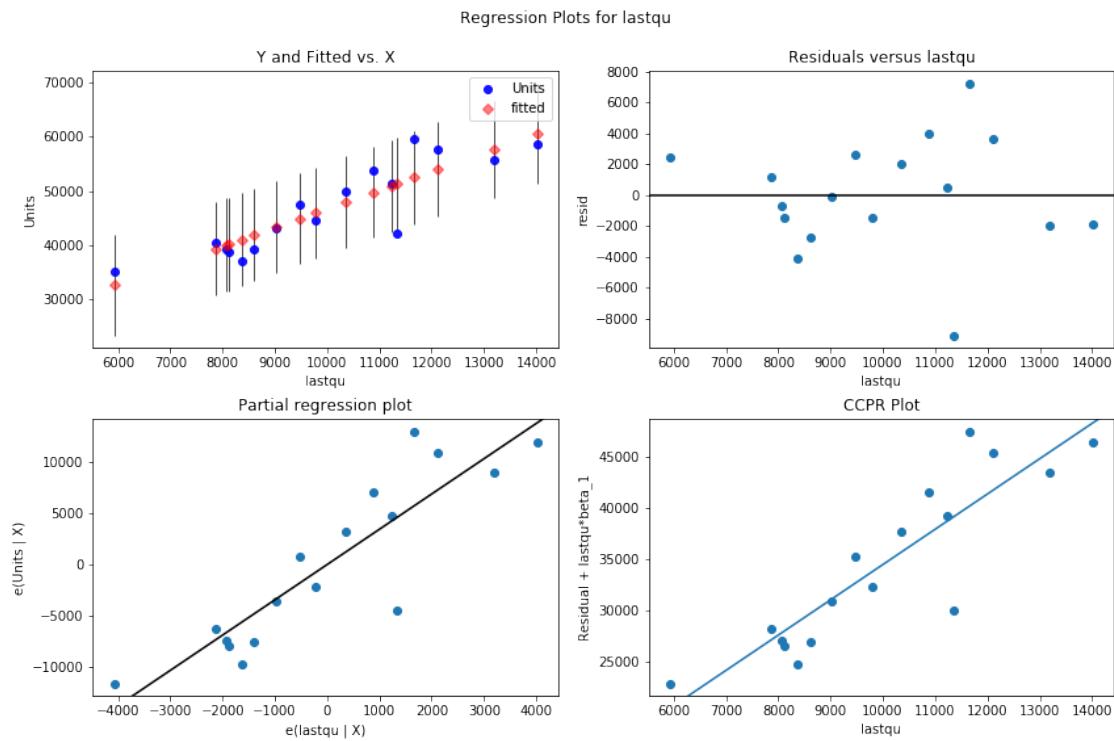
'Area mergedfcast: Statewide'

Statewide

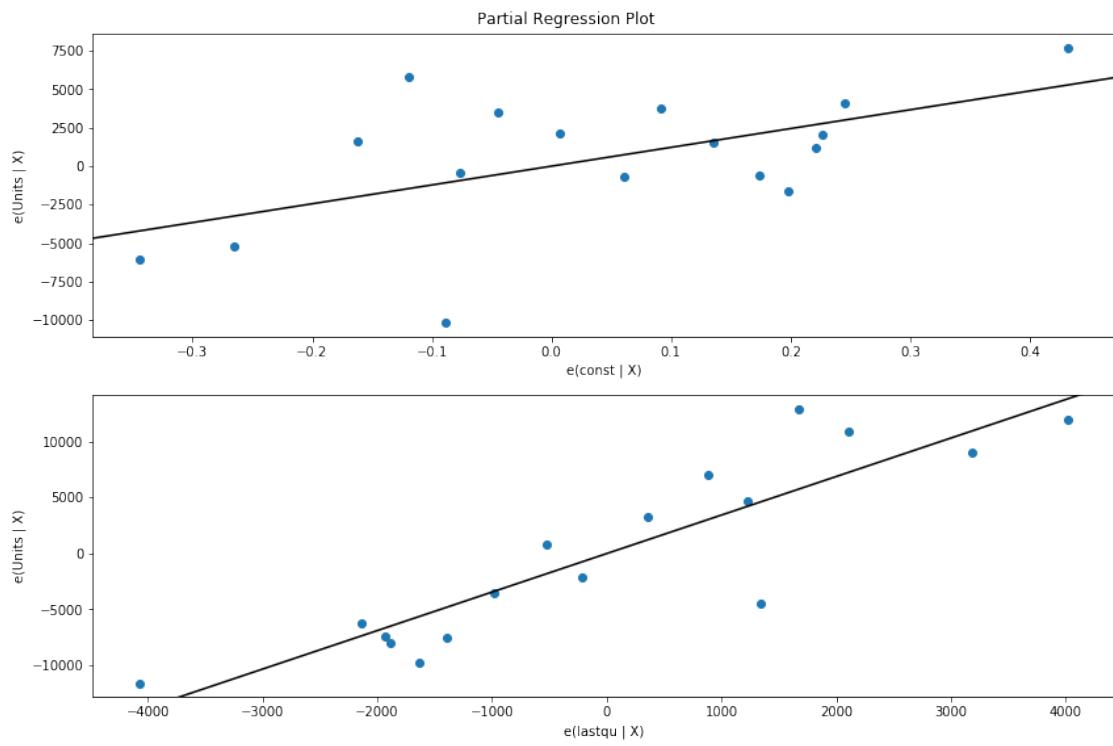
```
/home/tom/anaconda3/lib/python3.6/site-packages/ipykernel/_main_.py:149: MatplotlibDeprecationWarning
  Future behavior will be consistent with the long-time default:
    plot commands add elements without first clearing the
      Axes and/or Figure.
/home/tom/anaconda3/lib/python3.6/site-packages/matplotlib/__init__.py:805: MatplotlibDeprecationWarning
  mplDeprecation)
/home/tom/anaconda3/lib/python3.6/site-packages/matplotlib/rcsetup.py:155: MatplotlibDeprecationWarning
  mplDeprecation)
```



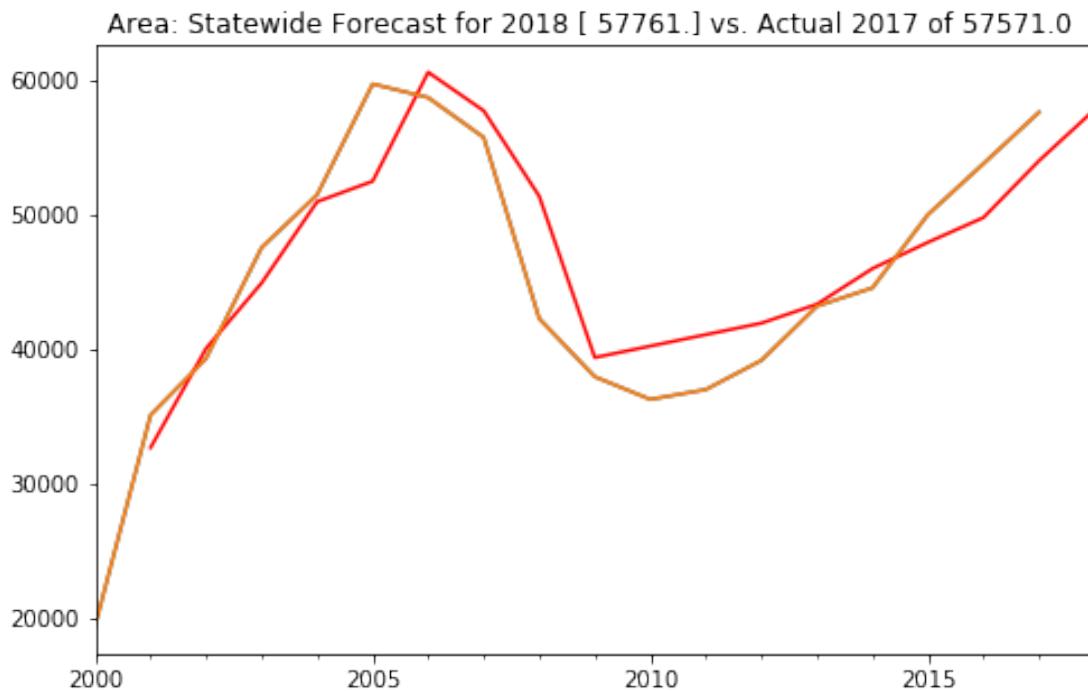
Statewide



Statewide



Statewide



```
'Area fcast summary: Athens'
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis
"anyway, n=%i" % int(n))
```

```
'Area regress: Athens'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:          Units      R-squared:     0.819
Model:                 OLS        Adj. R-squared:  0.793
Method:                Least Squares   F-statistic:   31.60
Date: Mon, 29 Jan 2018   Prob (F-statistic): 0.000798
Time: 16:56:28           Log-Likelihood: -56.243
No. Observations:      9            AIC:             116.5
Df Residuals:          7            BIC:             116.9
Df Model:              1
Covariance Type:       nonrobust
=====
      coef      std err          t      P>|t|      [0.025      0.975]

```

```

-----
const      33.8629    186.966     0.181      0.861    -408.241    475.966
lastqu     4.4881     0.798      5.622      0.001     2.600      6.376
=====
Omnibus:          0.329   Durbin-Watson:        1.581
Prob(Omnibus):   0.848   Jarque-Bera (JB):    0.096
Skew:            0.169   Prob(JB):           0.953
Kurtosis:        2.625   Cond. No.          925.
=====
```

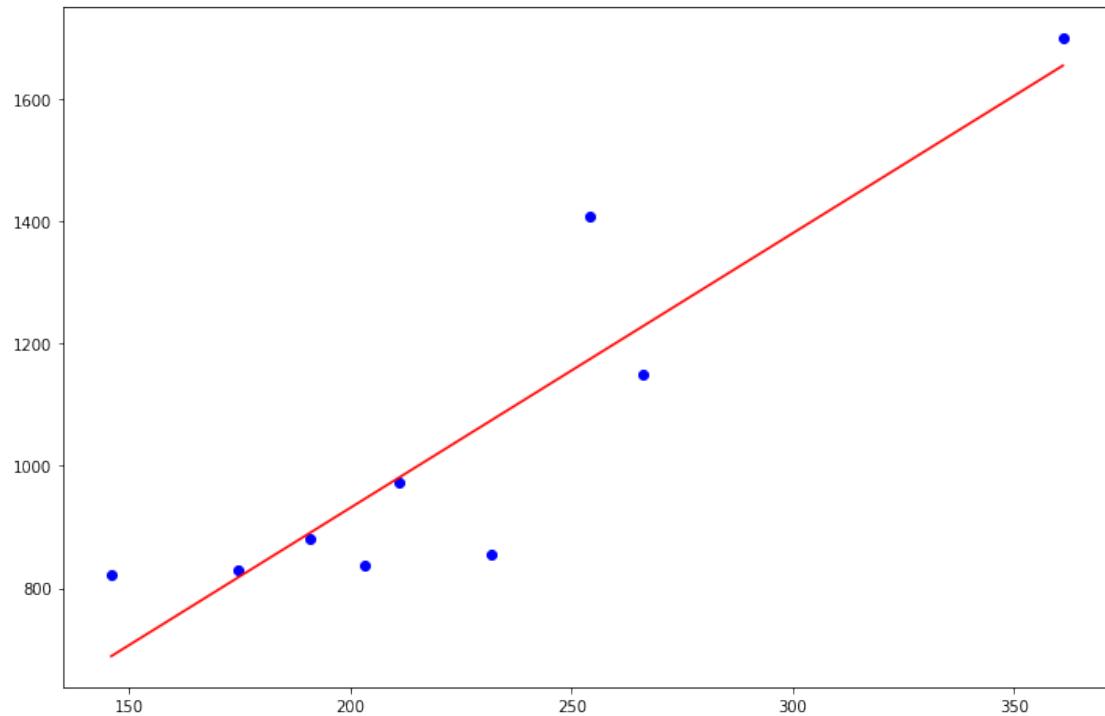
Warnings:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
"""

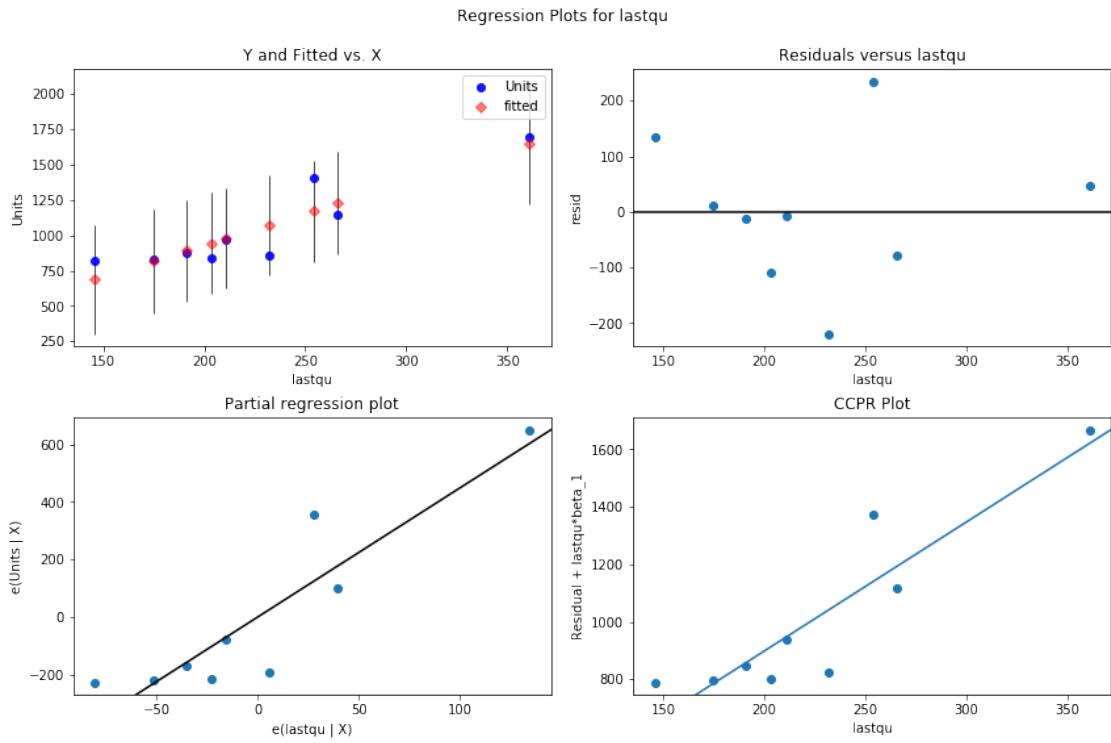
'Area Historical errors on Fcast: Athens'

'Area mergedfcast: Athens'

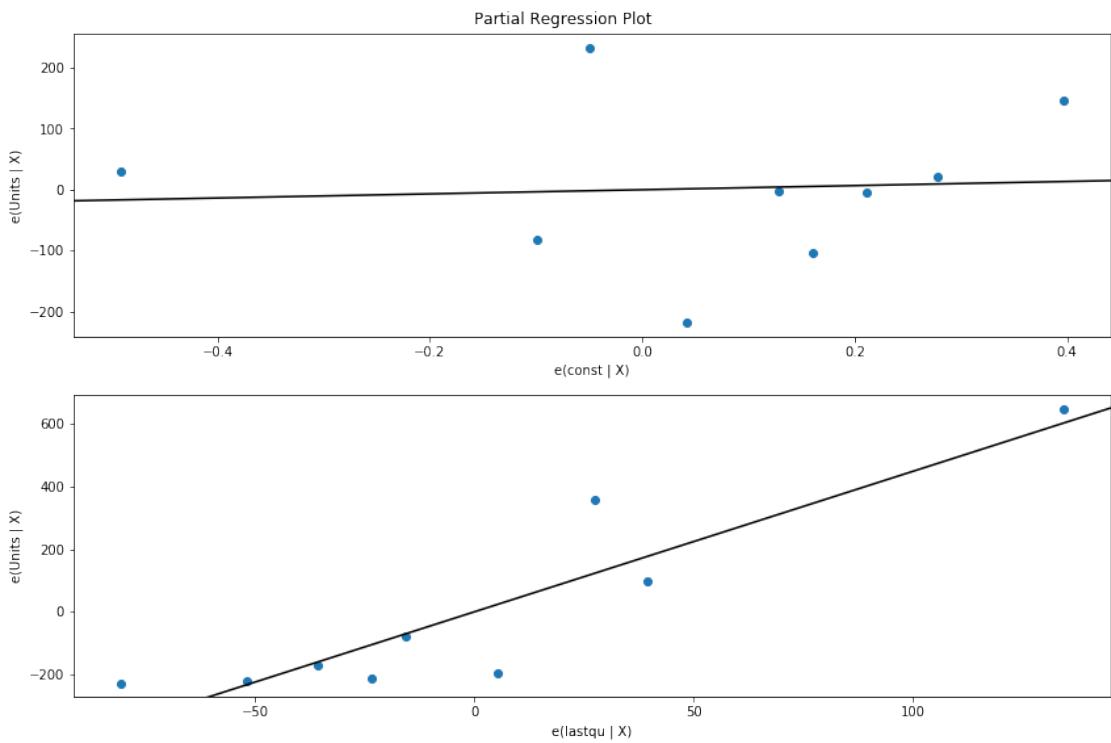
Athens



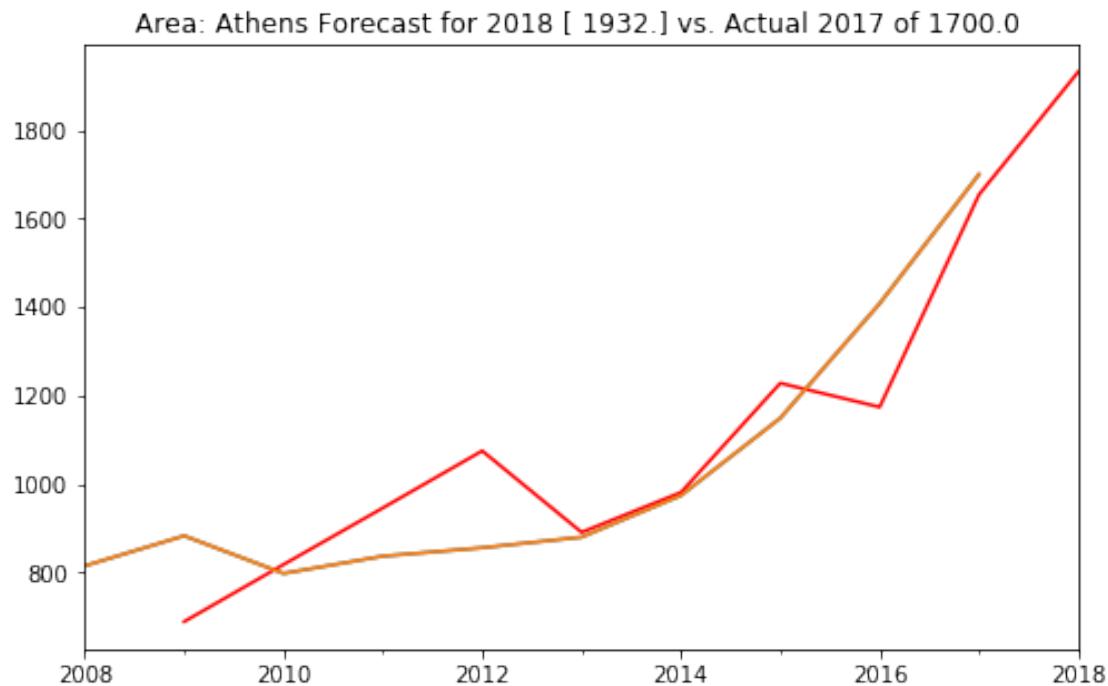
Athens



Athens



Athens



'Area fcast summary: Baldwin\_County'

/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis  
"anyway, n=%i" % int(n))

'Area regress: Baldwin\_County'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units
Model:                            OLS
Method:                           Least Squares
Date:    Mon, 29 Jan 2018
Time:    16:56:31
R-squared:                       0.935
Adj. R-squared:                   0.927
F-statistic:                     128.5
Prob (F-statistic):            1.25e-06
Log-Likelihood:                 -78.550
```

```

No. Observations:           11   AIC:                  161.1
Df Residuals:              9    BIC:                  161.9
Df Model:                  1
Covariance Type:          nonrobust
=====
            coef      std err       t     P>|t|      [0.025      0.975]
-----
const      185.5010    365.838     0.507     0.624     -642.082    1013.084
lastqu     4.5793      0.404     11.336     0.000      3.665      5.493
=====
Omnibus:                 2.251   Durbin-Watson:        1.576
Prob(Omnibus):            0.324   Jarque-Bera (JB):    1.536
Skew:                   -0.836   Prob(JB):             0.464
Kurtosis:                 2.255   Cond. No.          3.25e+03
=====

```

Warnings:

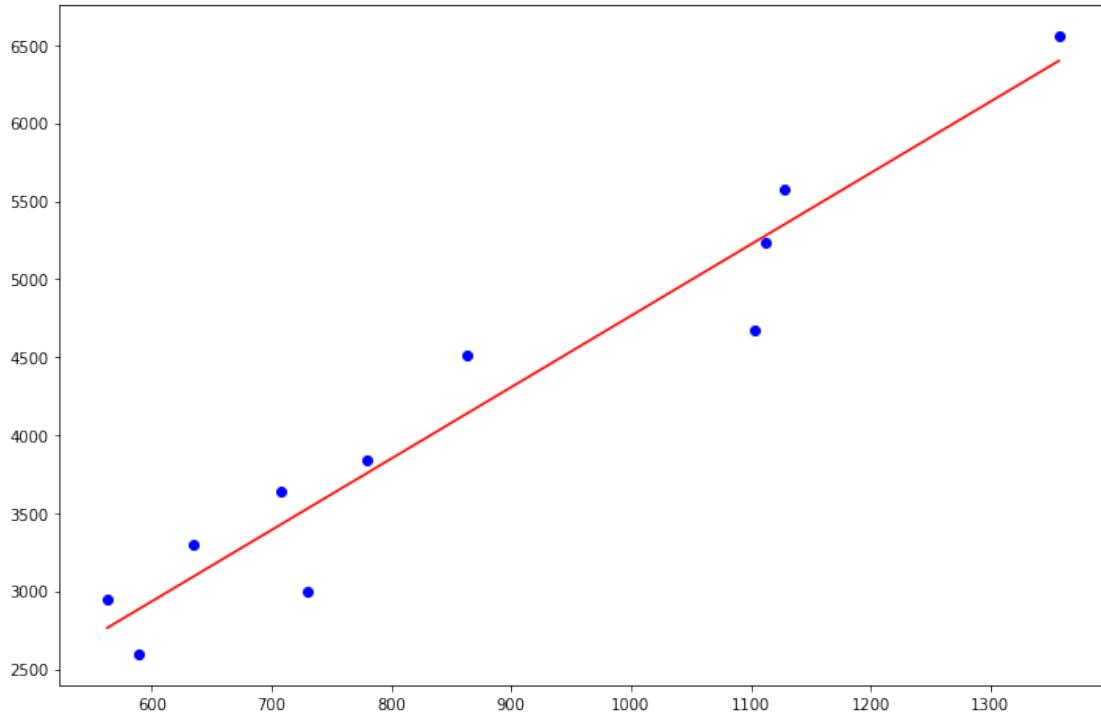
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
[2] The condition number is large, 3.25e+03. This might indicate that there are  
strong multicollinearity or other numerical problems.

"""

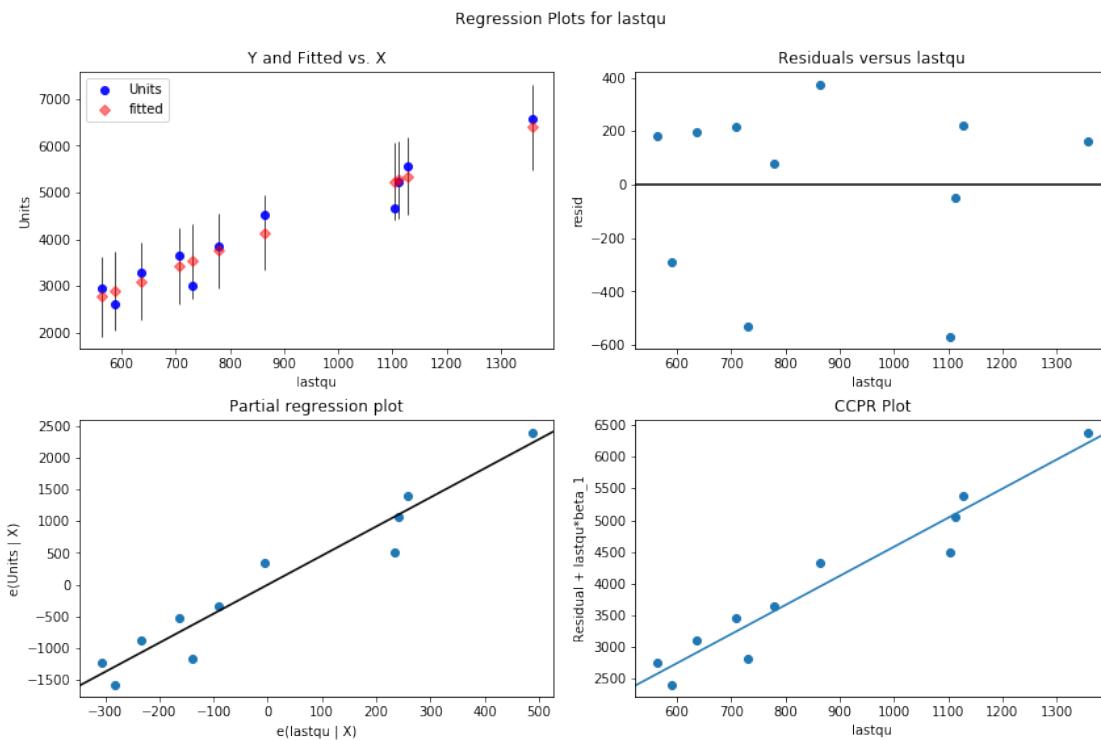
'Area Historical errors on Fcast: Baldwin\_County'

'Area mergedfcast: Baldwin\_County'

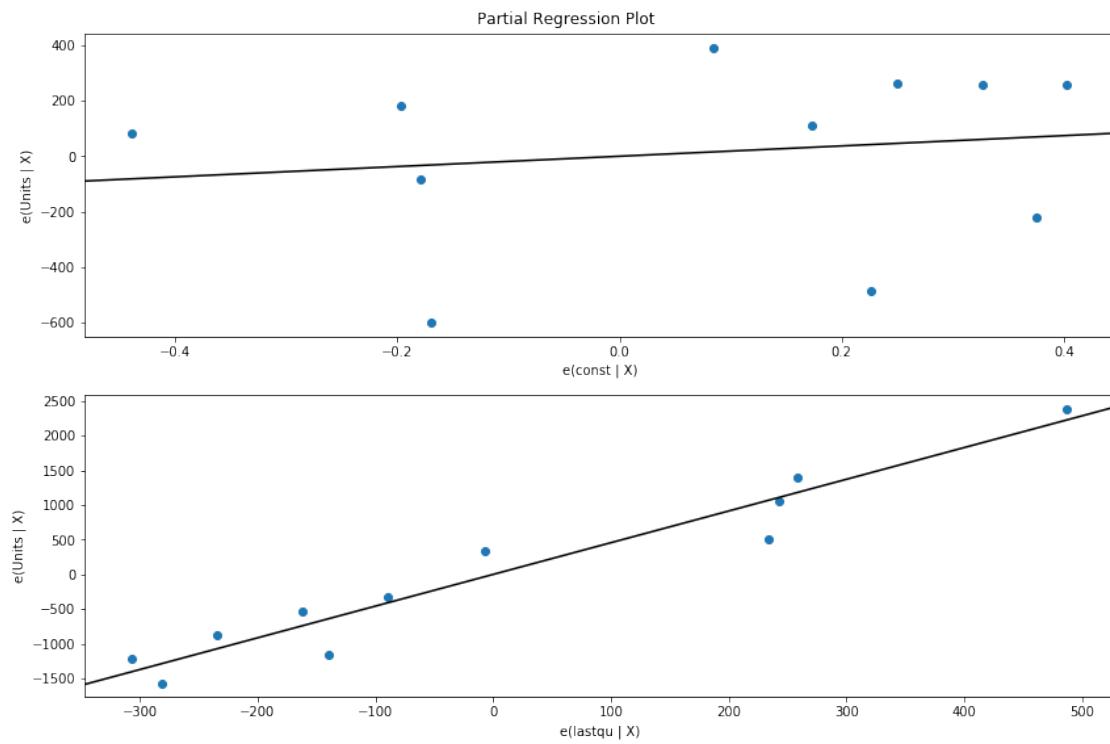
Baldwin\_County



Baldwin\_County

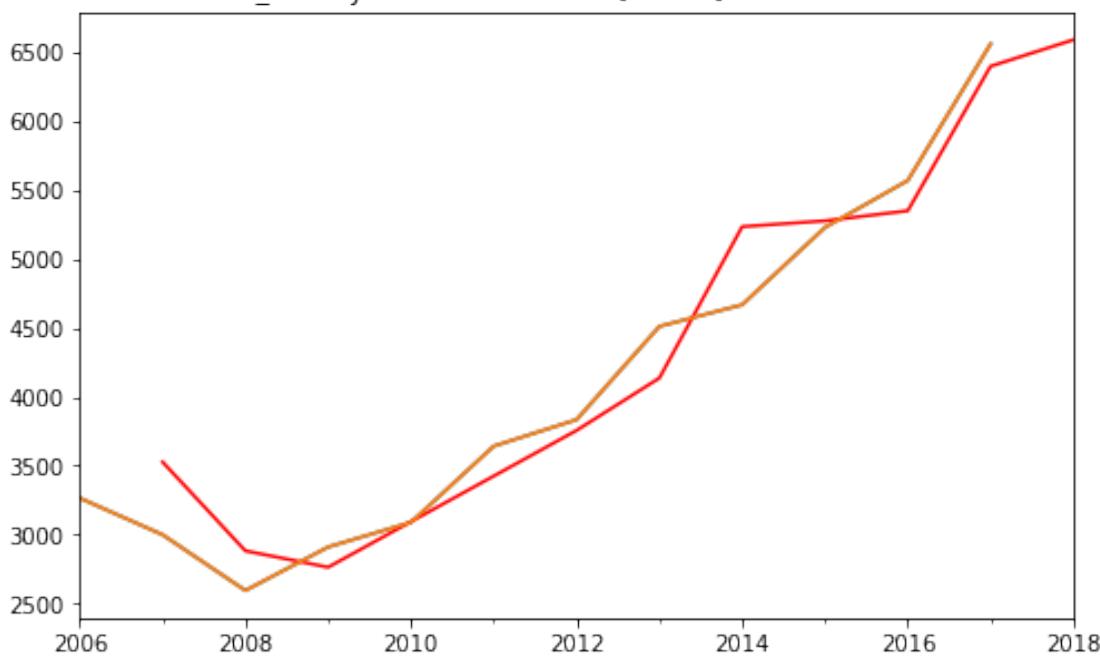


## Baldwin\_County



## Baldwin\_County

Area: Baldwin\_County Forecast for 2018 [ 6592.] vs. Actual 2017 of 6562.0



```
'Area fcast summary: Baldwin_Condos'
```

```
'Area regress: Baldwin_Condos'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.845
Model:                            OLS      Adj. R-squared:            0.827
Method:                           Least Squares      F-statistic:             48.92
Date:                          Mon, 29 Jan 2018      Prob (F-statistic):       6.37e-05
Time:                            16:56:33      Log-Likelihood:          -69.352
No. Observations:                  11      AIC:                     142.7
Df Residuals:                      9      BIC:                     143.5
Df Model:                           1
Covariance Type:            nonrobust
=====
              coef    std err          t      P>|t|      [0.025      0.975]
-----
const      97.9857   169.306      0.579      0.577     -285.011     480.982
lastqu     4.3303     0.619      6.994      0.000        2.930      5.731
=====
```

Omnibus:	1.062	Durbin-Watson:	2.303
Prob(Omnibus):	0.588	Jarque-Bera (JB):	0.749
Skew:	-0.567	Prob(JB):	0.688
Kurtosis:	2.408	Cond. No.	1.05e+03

---

Warnings:

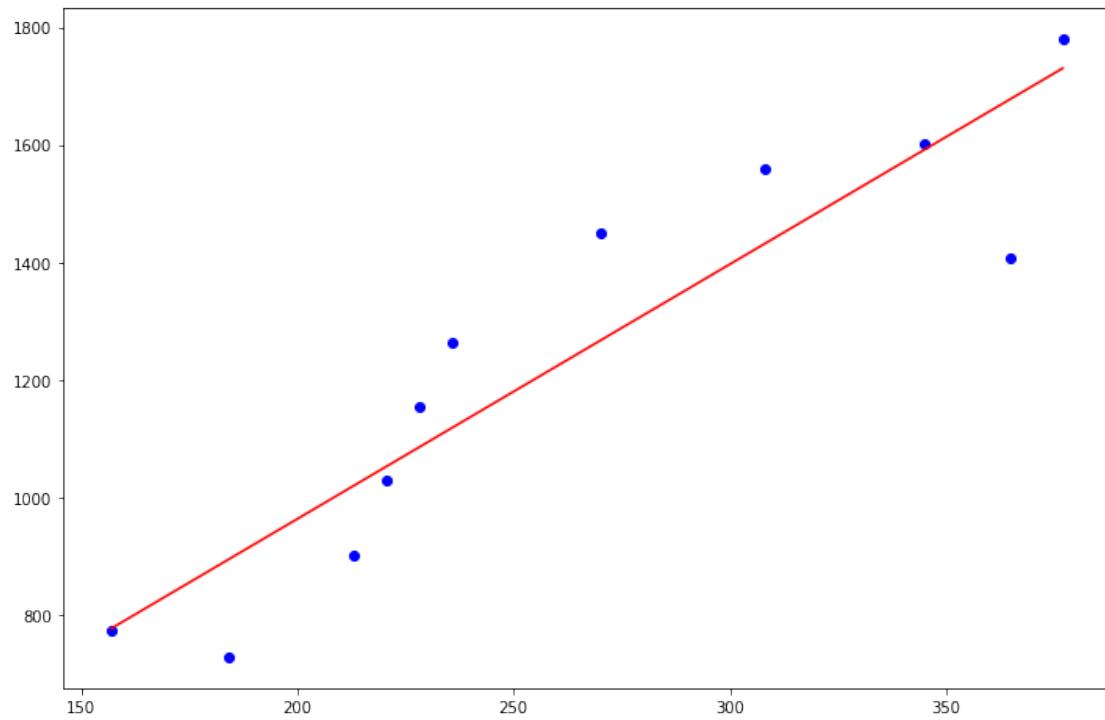
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
[2] The condition number is large, 1.05e+03. This might indicate that there are strong multicollinearity or other numerical problems.

"""

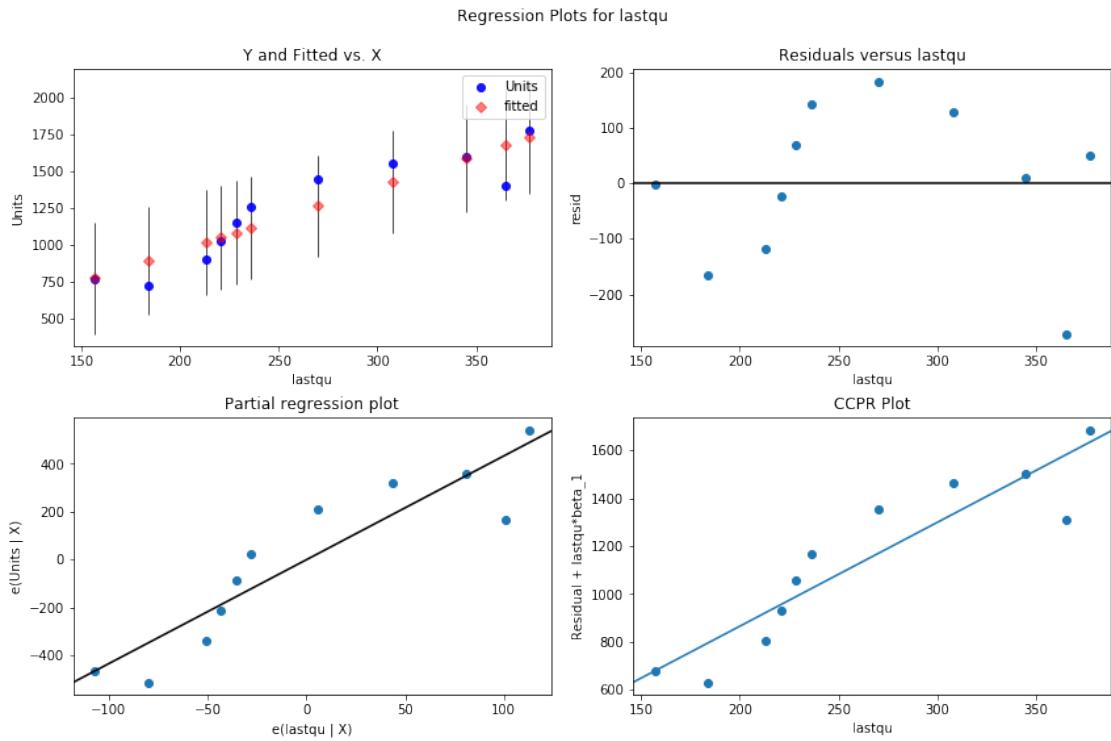
'Area Historical errors on Fcast: Baldwin\_Condos'

'Area mergedfcast: Baldwin\_Condos'

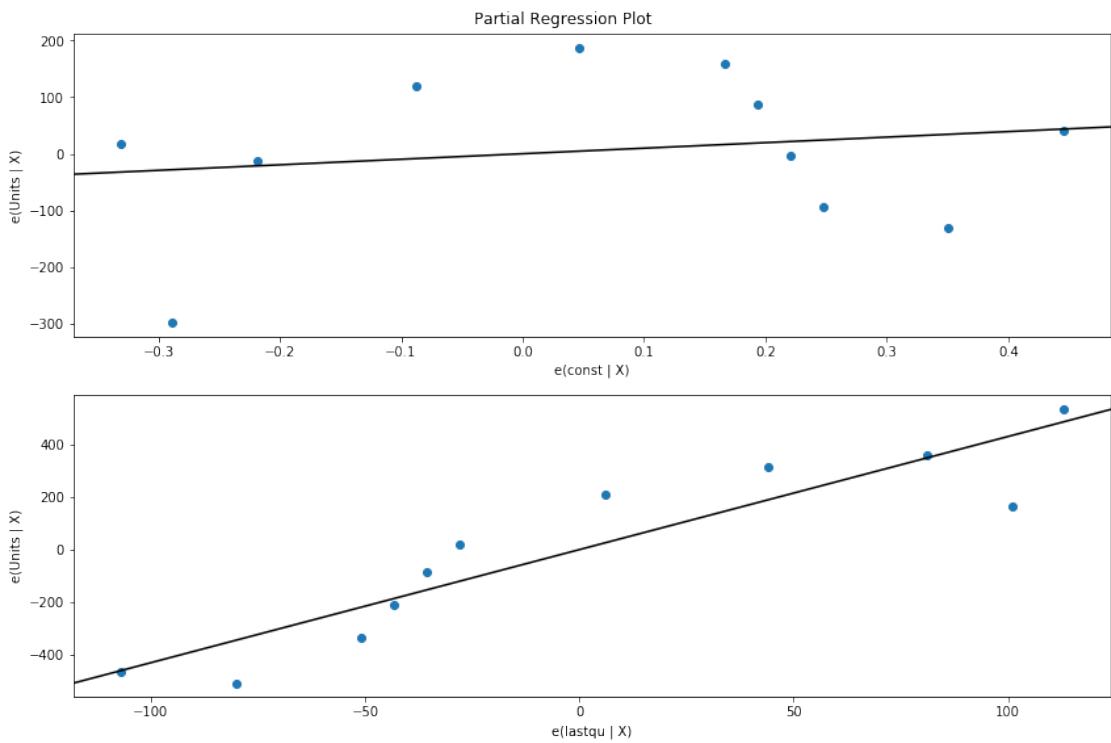
Baldwin\_Condos



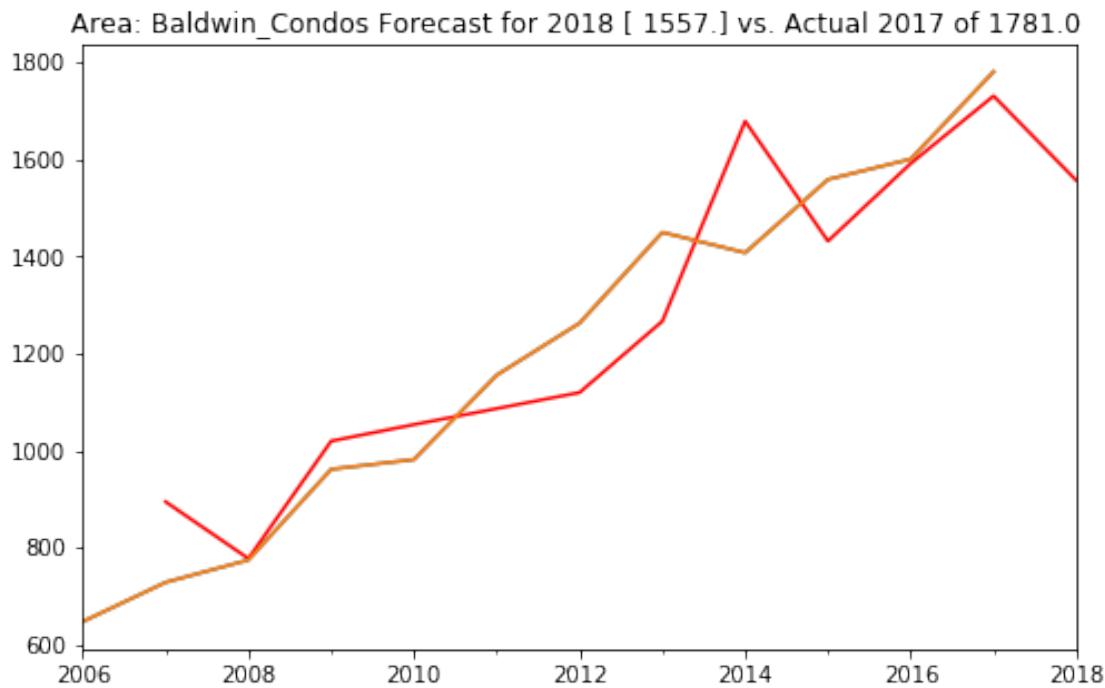
Baldwin\_Condos



### Baldwin\_Condos



Baldwin\_Condos



'Area fcast summary: Birmingham'

'Area regress: Birmingham'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
=====
              OLS Regression Results
=====
Dep. Variable:                      Units
Model:                            OLS
Method:                           Least Squares
Date: Mon, 29 Jan 2018
Time: 16:56:36
No. Observations:                  17
Df Residuals:                     15
Df Model:                          1
Covariance Type:                 nonrobust
R-squared:                         0.838
Adj. R-squared:                   0.827
F-statistic:                      77.72
Prob (F-statistic):               2.55e-07
Log-Likelihood:                  -141.37
AIC:                             286.7
BIC:                             288.4
```

	coef	std err	t	P> t	[0.025	0.975]
const	3105.7368	1229.693	2.526	0.023	484.708	5726.766
lastqu	3.6880	0.418	8.816	0.000	2.796	4.580
<hr/>						
Omnibus:		1.082	Durbin-Watson:		1.788	
Prob(Omnibus):		0.582	Jarque-Bera (JB):		0.230	
Skew:		0.266	Prob(JB):		0.891	
Kurtosis:		3.204	Cond. No.			1.42e+04
<hr/>						

Warnings:

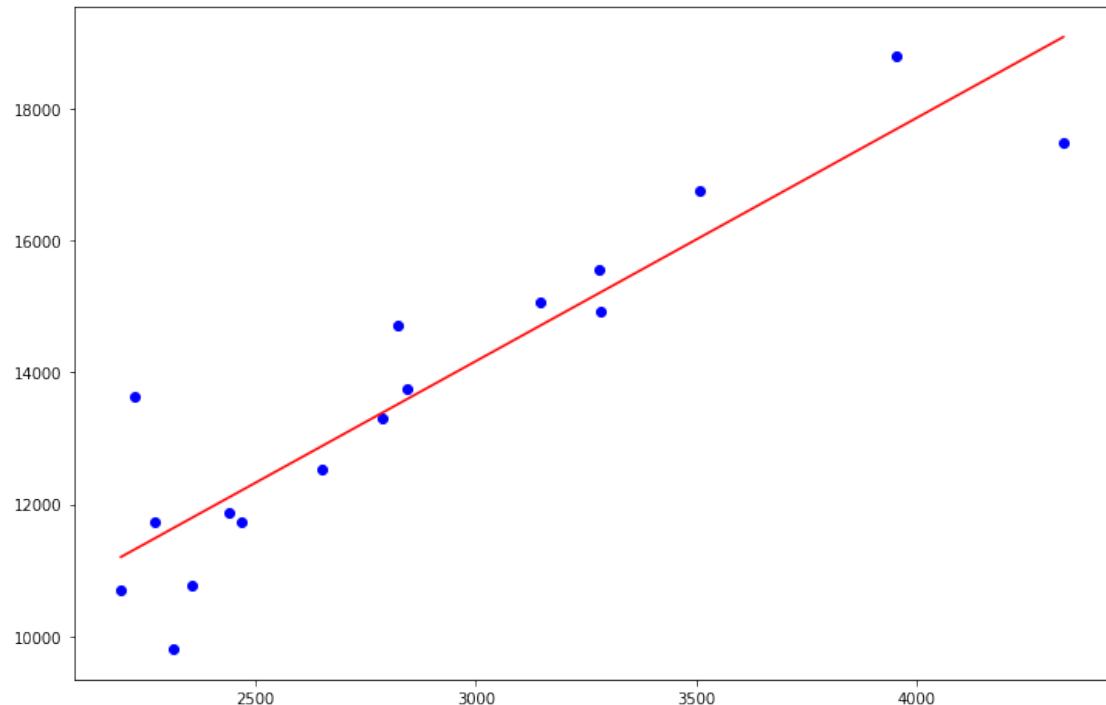
- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 1.42e+04. This might indicate that there are strong multicollinearity or other numerical problems.

"""

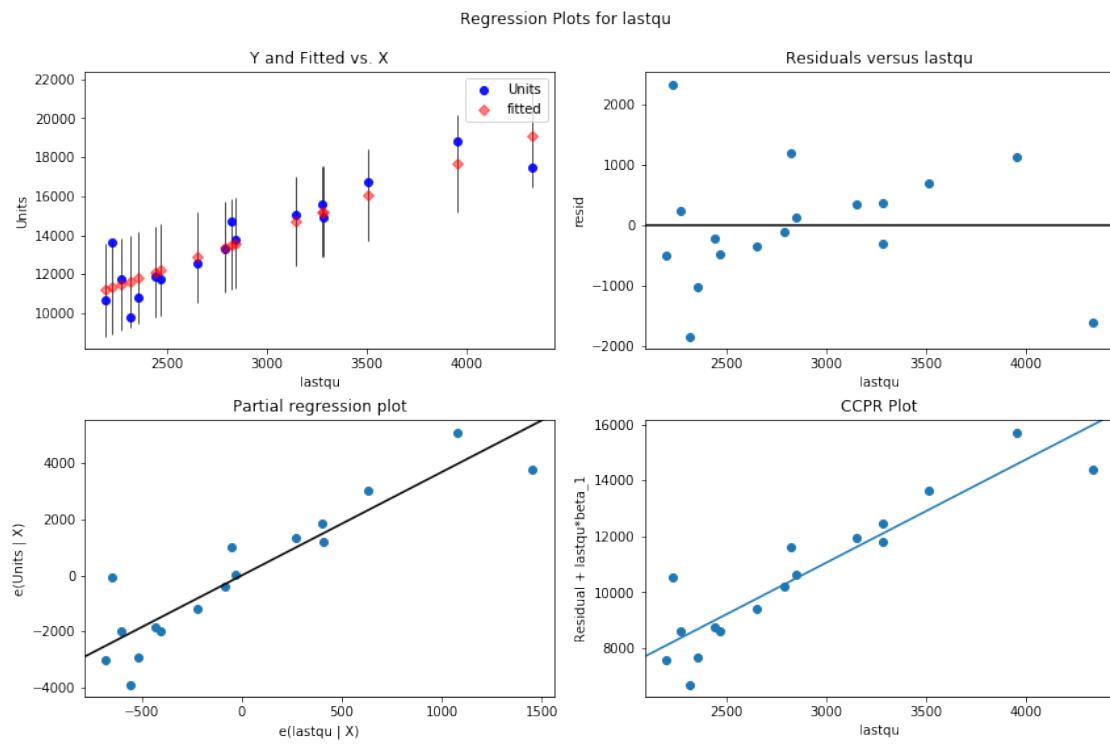
'Area Historical errors on Fcast: Birmingham'

'Area mergedfcast: Birmingham'

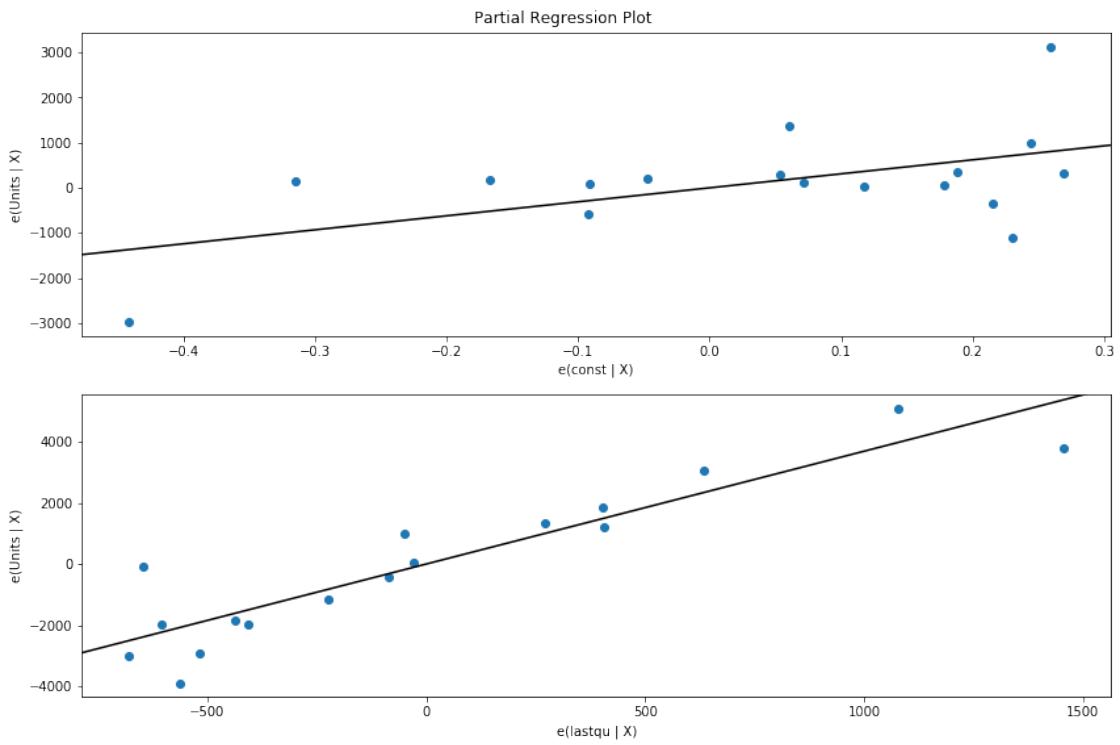
Birmingham



## Birmingham

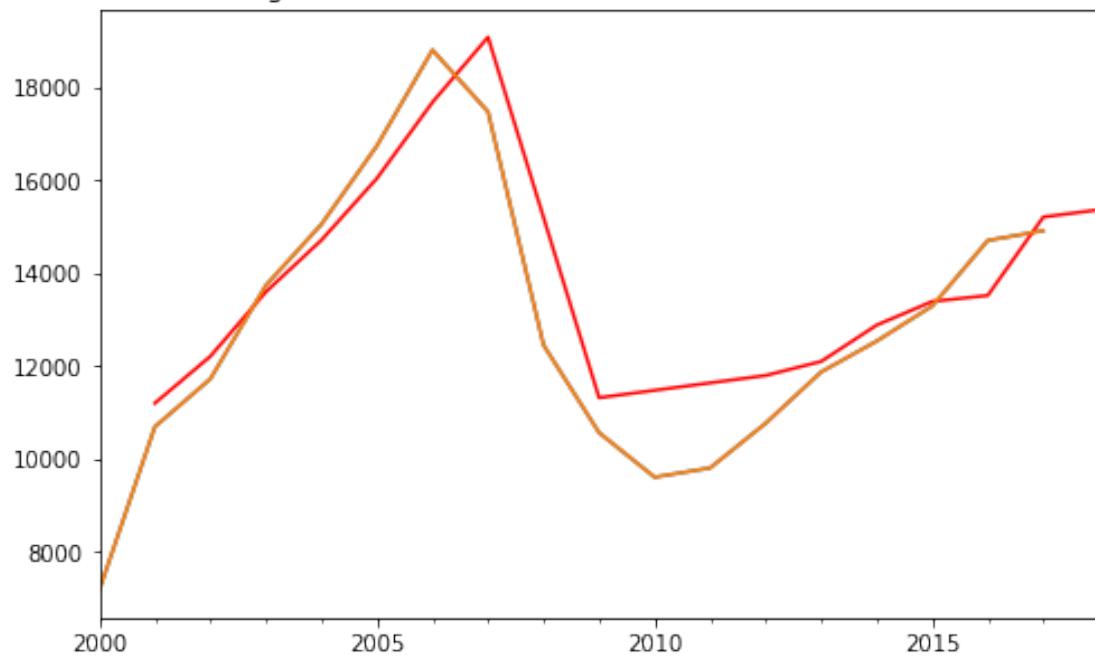


## Birmingham



Birmingham

Area: Birmingham Forecast for 2018 [ 15365.] vs. Actual 2017 of 14915.0



```
'Area fcast summary: Calhoun'
```

```
'Area regress: Calhoun'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.813
Model:                             OLS      Adj. R-squared:            0.801
Method:                            Least Squares      F-statistic:              65.42
Date:    Mon, 29 Jan 2018      Prob (F-statistic):        7.52e-07
Time:          16:56:40      Log-Likelihood:           -100.93
No. Observations:                  17      AIC:                     205.9
Df Residuals:                      15      BIC:                     207.5
Df Model:                           1
Covariance Type:                nonrobust
=====
            coef      std err          t      P>|t|      [0.025      0.975]
-----
const     114.5667    135.145      0.848      0.410     -173.488     402.621
lastqu     4.0993     0.507      8.088      0.000       3.019      5.180
=====
Omnibus:                   0.394      Durbin-Watson:             1.981
Prob(Omnibus):               0.821      Jarque-Bera (JB):         0.036
Skew:                       0.109      Prob(JB):                  0.982
Kurtosis:                    2.941      Cond. No.            1.52e+03
=====
```

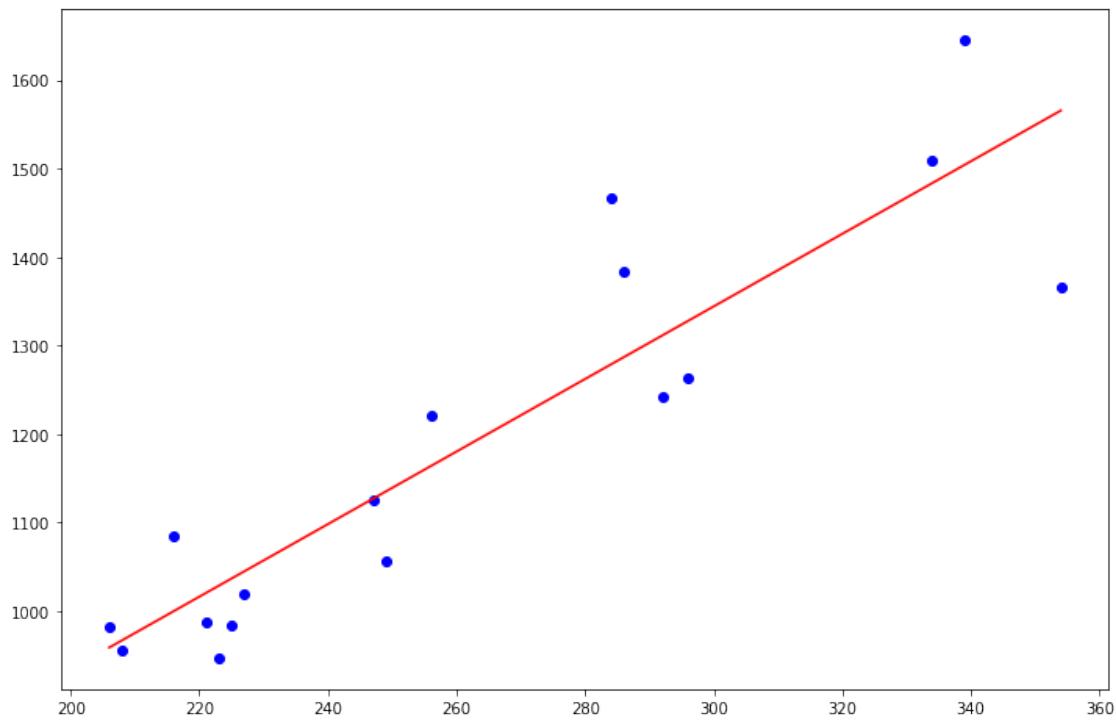
Warnings:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
  - [2] The condition number is large, 1.52e+03. This might indicate that there are strong multicollinearity or other numerical problems.
- """

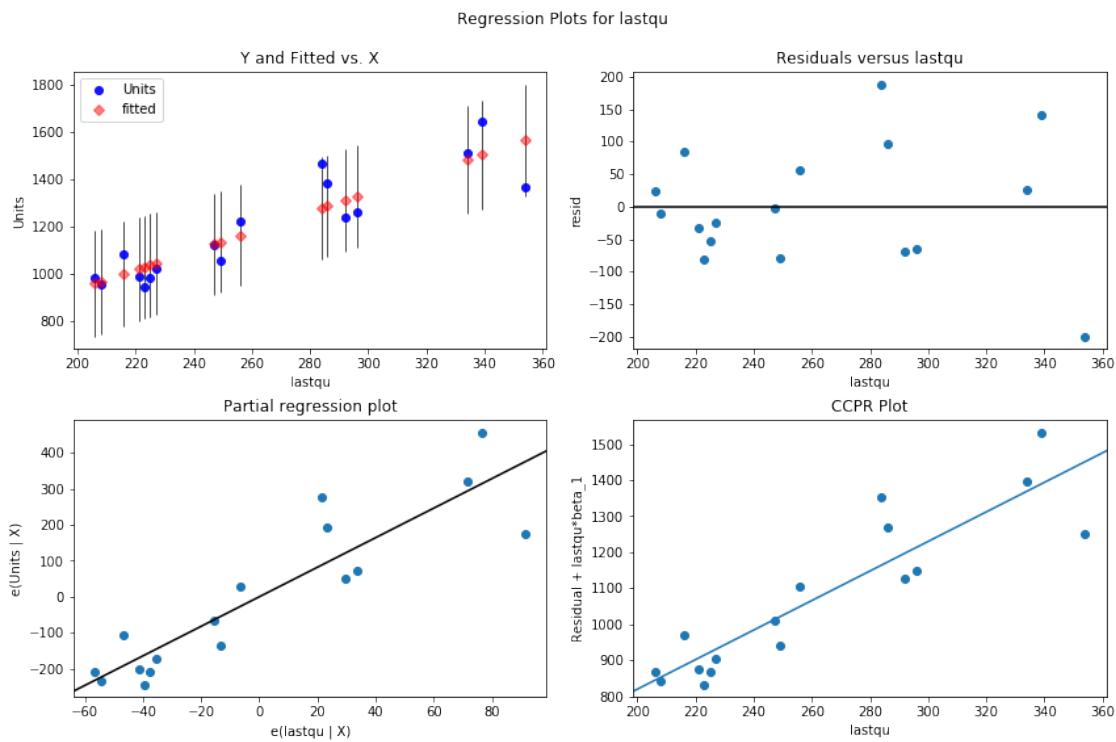
```
'Area Historical errors on Fcast: Calhoun'
```

```
'Area mergedfcast: Calhoun'
```

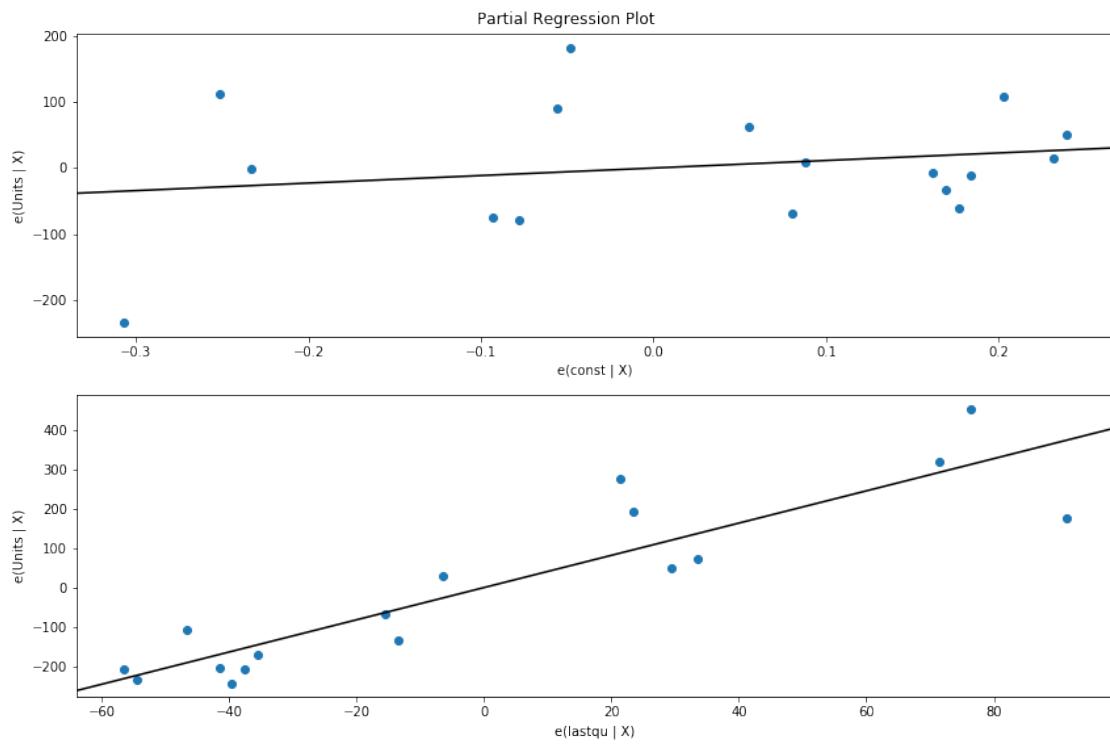
Calhoun



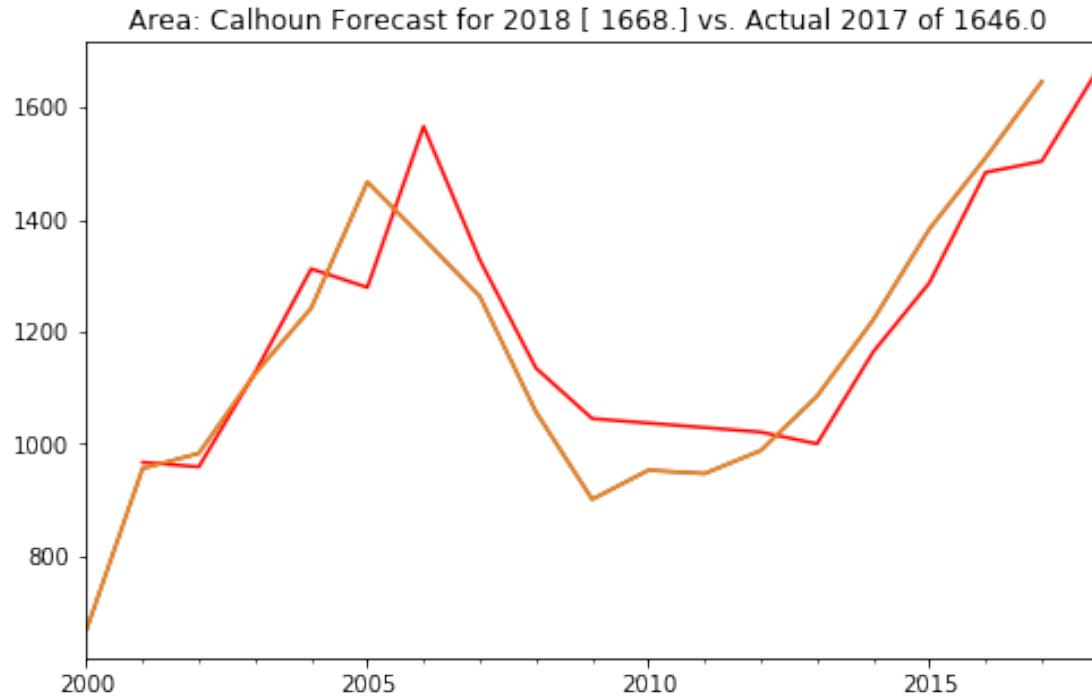
Calhoun



Calhoun



Calhoun



```
'Area fcast summary: Cherokee'
```

```
'Area regress: Cherokee'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.646
Model:                            OLS      Adj. R-squared:            0.606
Method:                           Least Squares      F-statistic:             16.40
Date:                            Mon, 29 Jan 2018      Prob (F-statistic):        0.00289
Time:                             16:56:43      Log-Likelihood:          -50.456
No. Observations:                  11      AIC:                     104.9
Df Residuals:                      9      BIC:                     105.7
Df Model:                          1
Covariance Type:                nonrobust
=====
              coef    std err          t      P>|t|      [0.025      0.975]
-----
const     -2.8414    38.743     -0.073      0.943     -90.485     84.802
lastqu     5.1502     1.272      4.049      0.003      2.273      8.027
```

```
=====
Omnibus:                      1.461   Durbin-Watson:          1.732
Prob(Omnibus):                0.482   Jarque-Bera (JB):    0.762
Skew:                          0.095   Prob(JB):            0.683
Kurtosis:                     1.725   Cond. No.           149.
=====
```

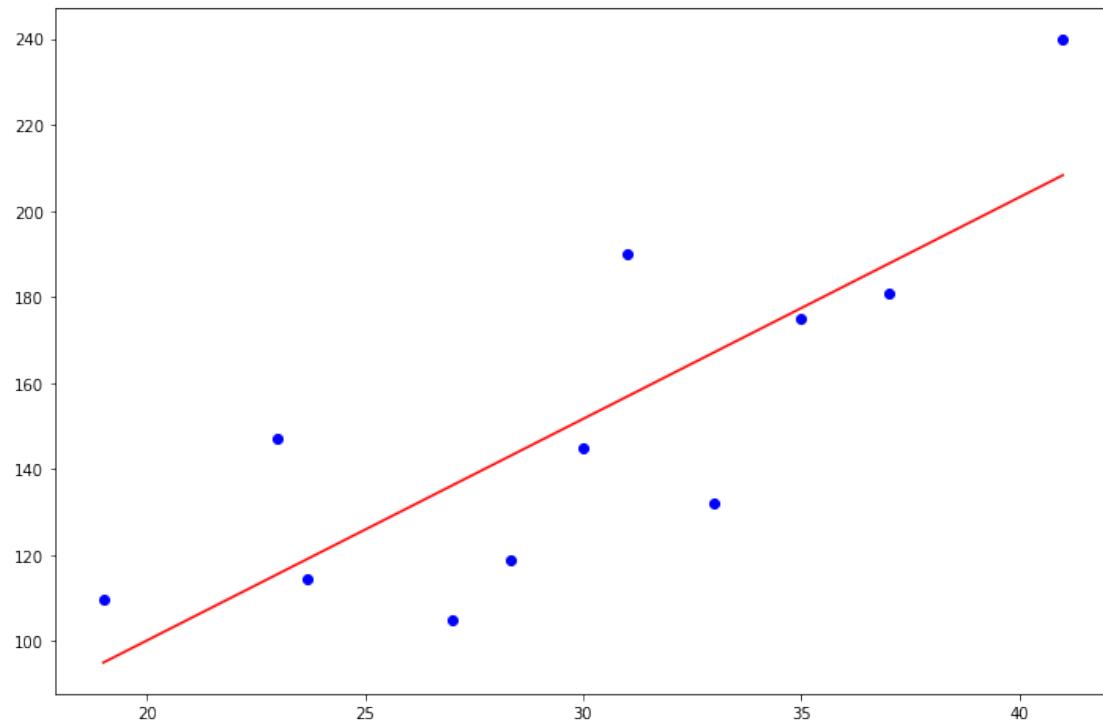
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
***
```

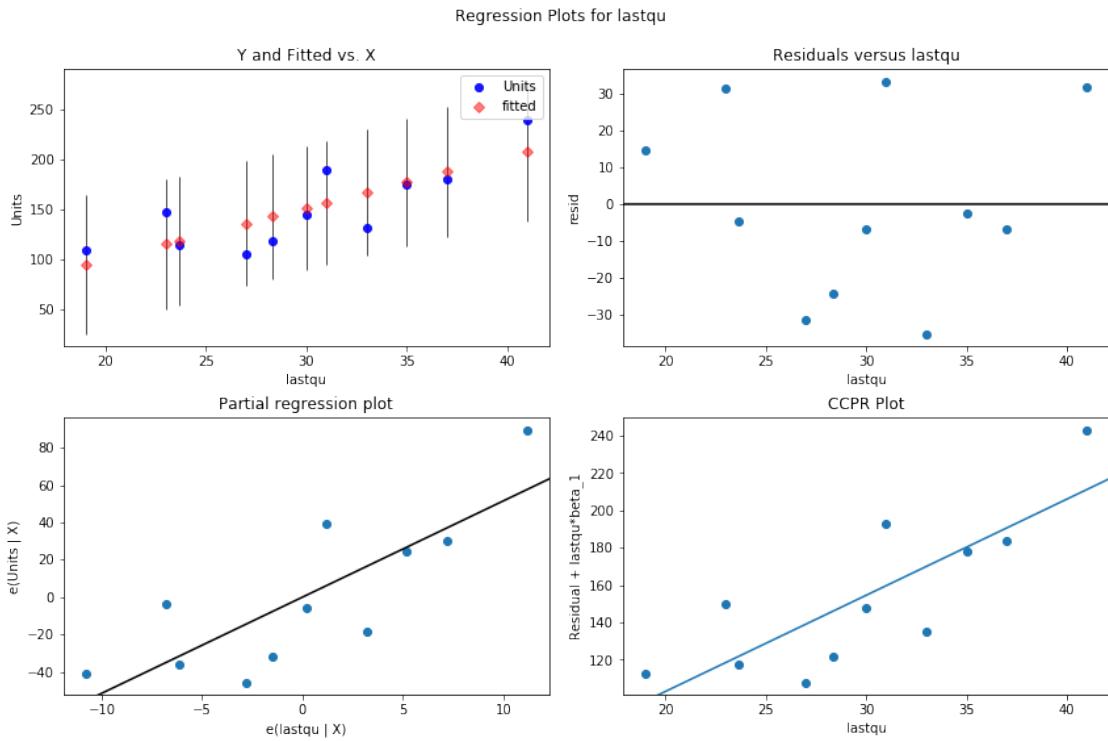
'Area Historical errors on Fcast: Cherokee'

'Area mergedfcast: Cherokee'

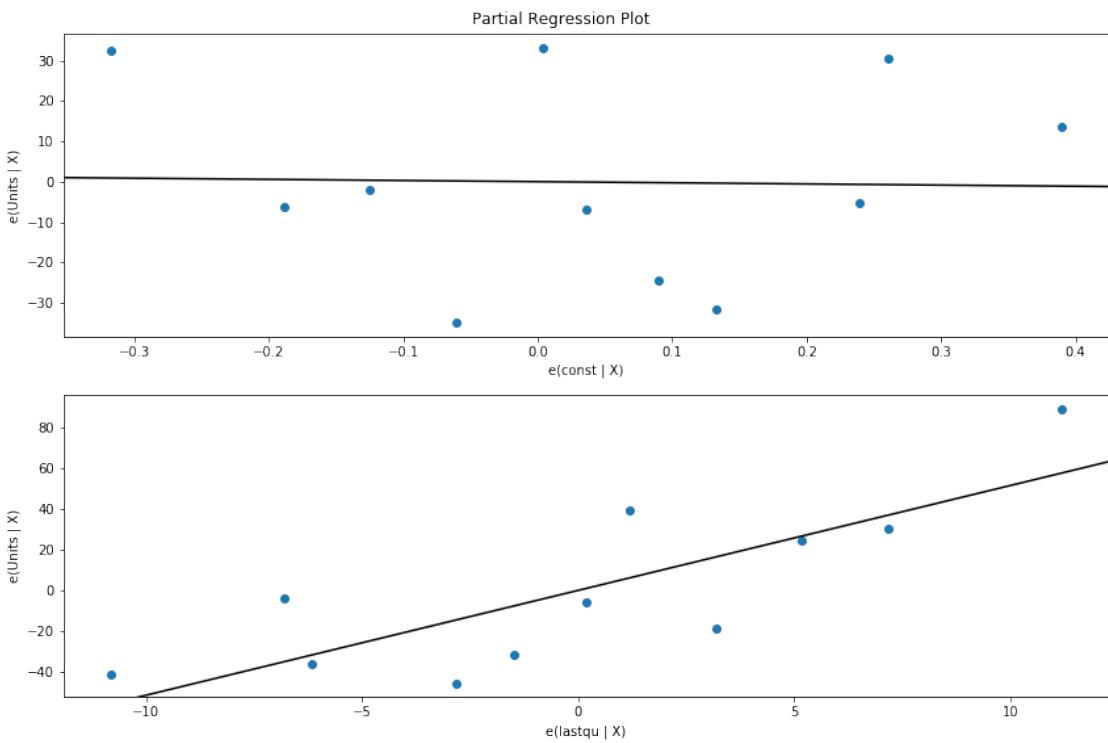
Cherokee



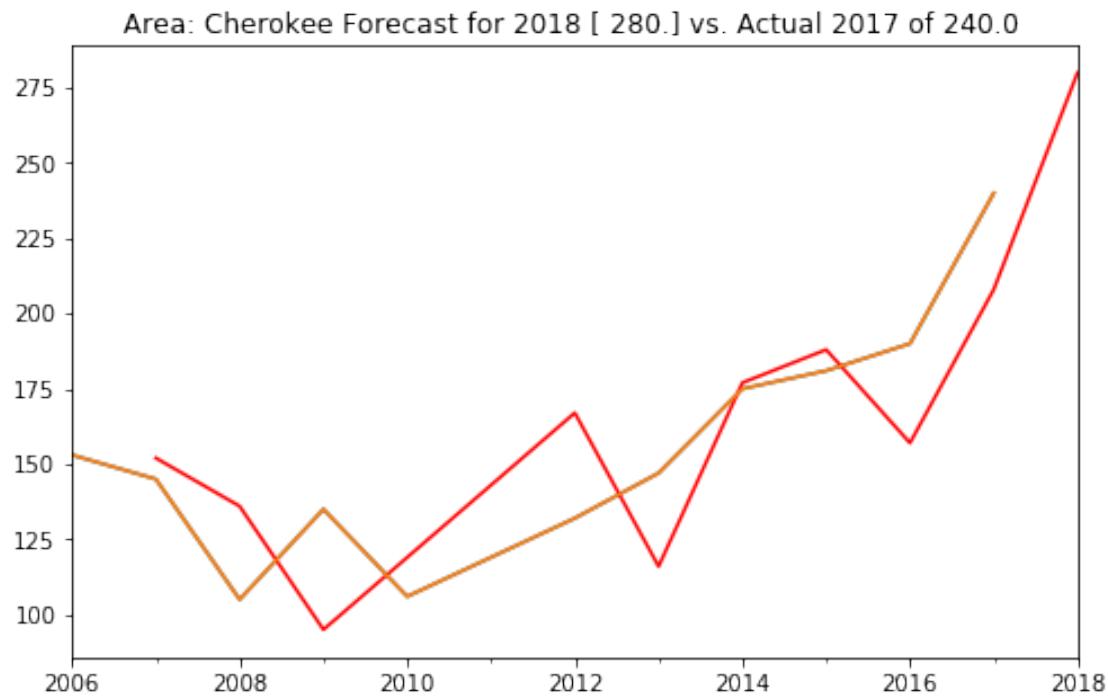
Cherokee



## Cherokee



Cherokee



'Area fcast summary: Covington'

```
/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis  
    "anyway, n=%i" % int(n))
```

'Area regress: Covington'

```
<class 'statsmodels.iolib.summary.Summary'>  
"""\n        OLS Regression Results\n=====  
Dep. Variable:                      Units      R-squared:                 0.515  
Model:                            OLS      Adj. R-squared:             0.474  
Method:                           Least Squares      F-statistic:                12.73  
Date: Mon, 29 Jan 2018      Prob (F-statistic):        0.00387  
Time: 16:56:46                  Log-Likelihood:          -71.899
```

```

No. Observations:           14   AIC:                  147.8
Df Residuals:              12   BIC:                  149.1
Df Model:                  1
Covariance Type:           nonrobust
=====
          coef    std err      t    P>|t|    [0.025    0.975]
-----
const     96.2719    45.932    2.096    0.058    -3.806    196.350
lastqu    2.7702    0.776    3.568    0.004    1.078     4.462
=====
Omnibus:                 1.976   Durbin-Watson:        1.544
Prob(Omnibus):            0.372   Jarque-Bera (JB):    0.789
Skew:                     0.578   Prob(JB):             0.674
Kurtosis:                 3.119   Cond. No.            229.
=====
```

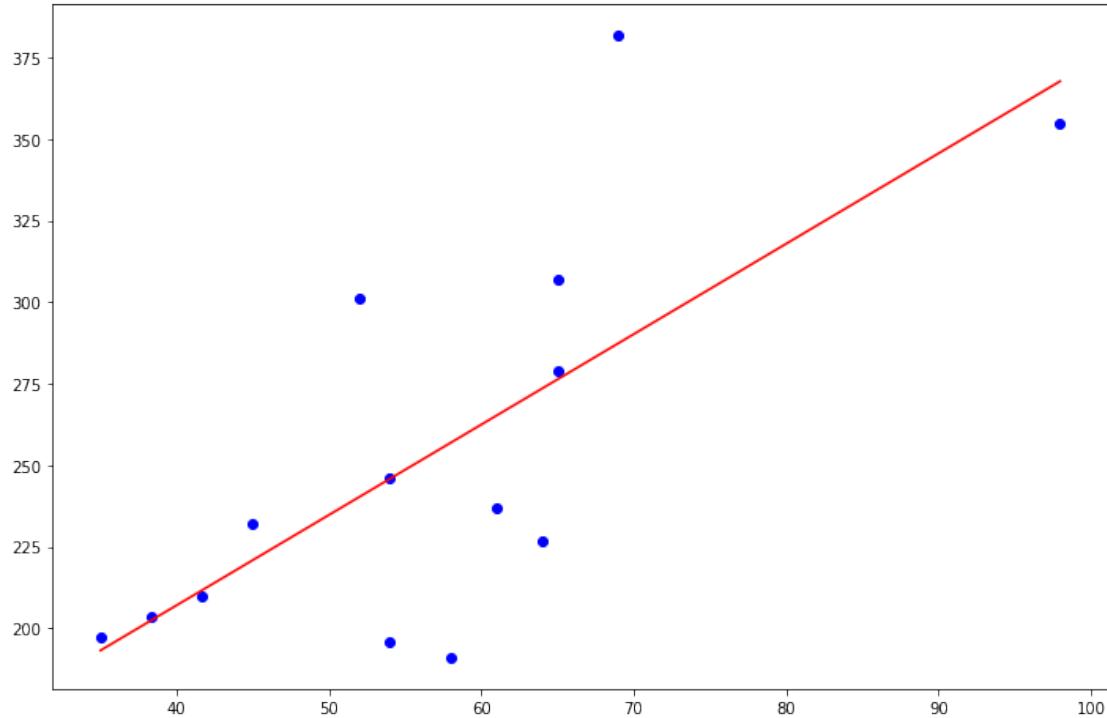
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
***
```

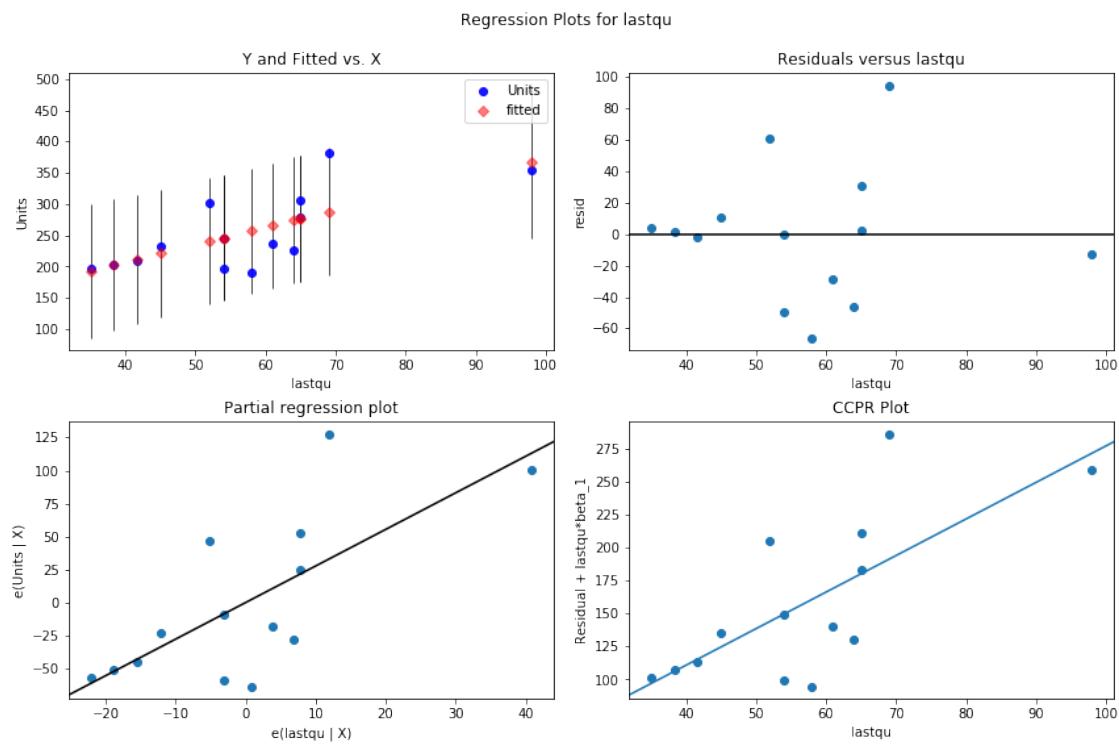
```
'Area Historical errors on Fcast: Covington'
```

```
'Area mergedfcast: Covington'
```

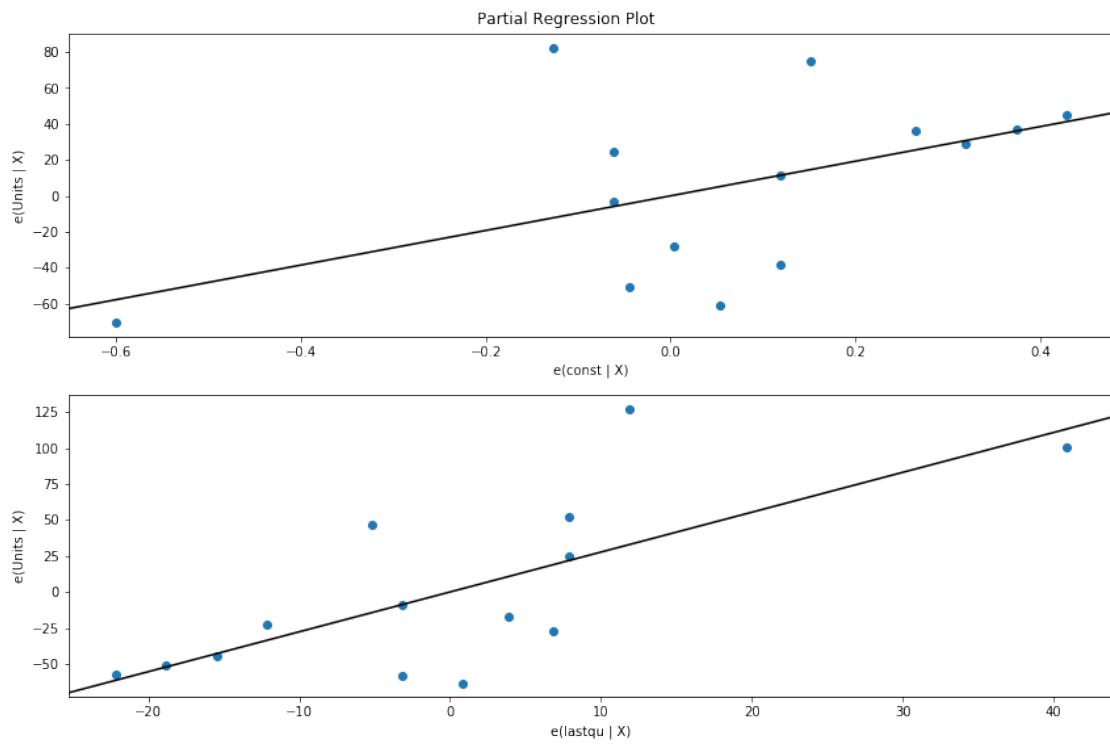
Covington



Covington

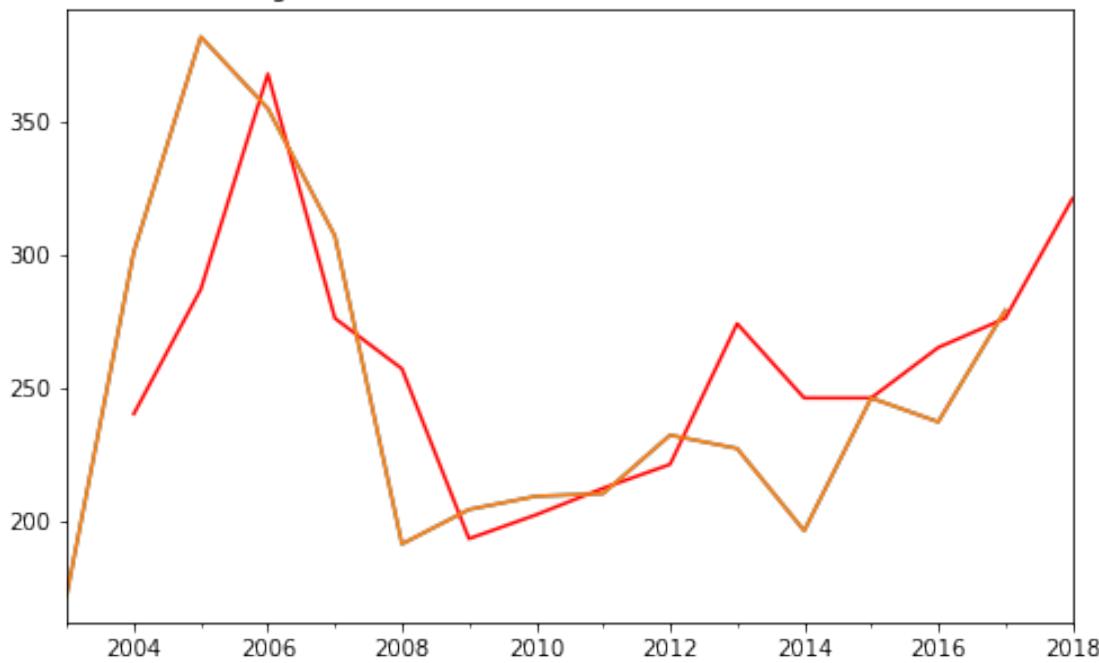


Covington



Covington

Area: Covington Forecast for 2018 [ 321.] vs. Actual 2017 of 279.0



'Area fcast summary: Cullman'

'Area regress: Cullman'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
=====
              OLS Regression Results
=====
Dep. Variable:                      Units
Model:                            OLS
Method:                           Least Squares
Date: Mon, 29 Jan 2018
Time: 16:56:47
No. Observations:                  17
Df Residuals:                     15
Df Model:                          1
Covariance Type:                nonrobust
=====
            coef    std err          t      P>|t|      [0.025      0.975]
-----
const    110.6208    70.469      1.570      0.137     -39.580     260.822
lastqu    4.0150     0.496      8.087      0.000       2.957      5.073
```

```
=====
Omnibus:                      0.876   Durbin-Watson:          1.758
Prob(Omnibus):                0.645   Jarque-Bera (JB):      0.707
Skew:                          0.114   Prob(JB):                  0.702
Kurtosis:                     2.028   Cond. No.                 722.
=====
```

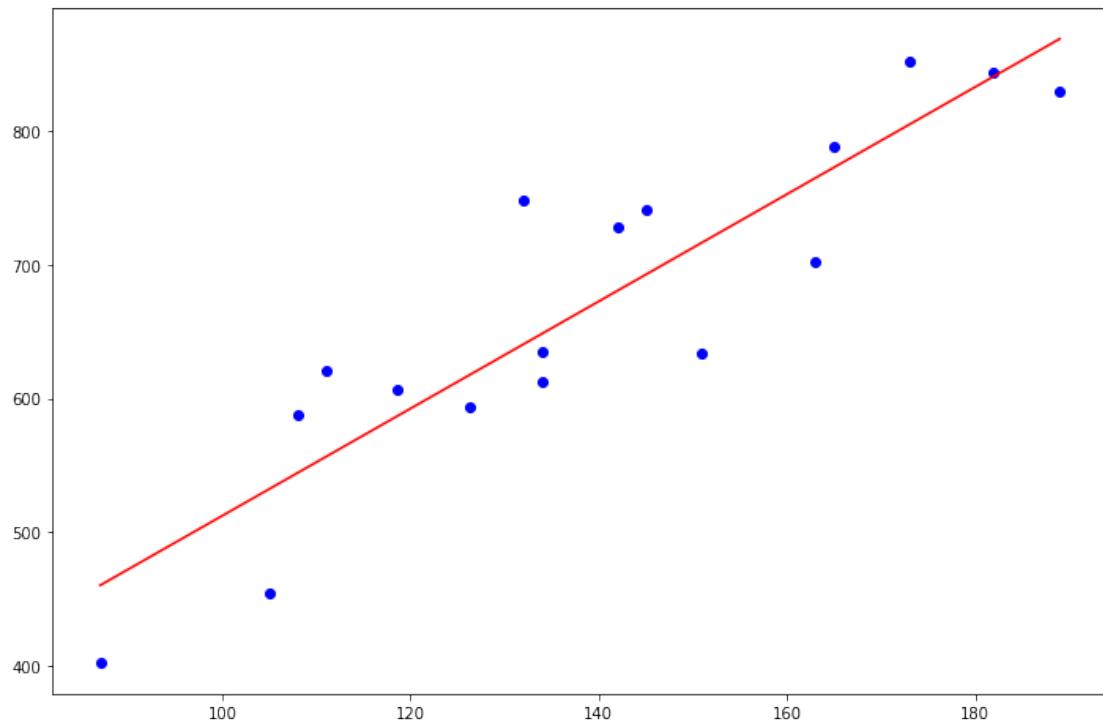
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
***
```

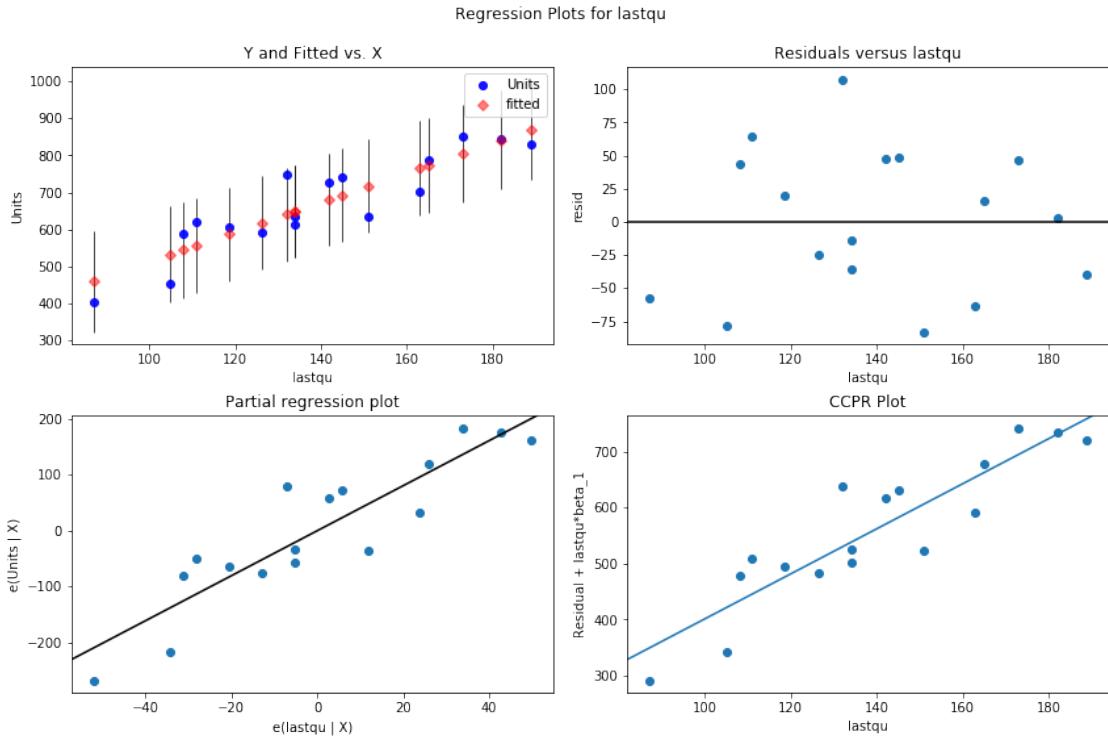
'Area Historical errors on Fcast: Cullman'

'Area mergedfcast: Cullman'

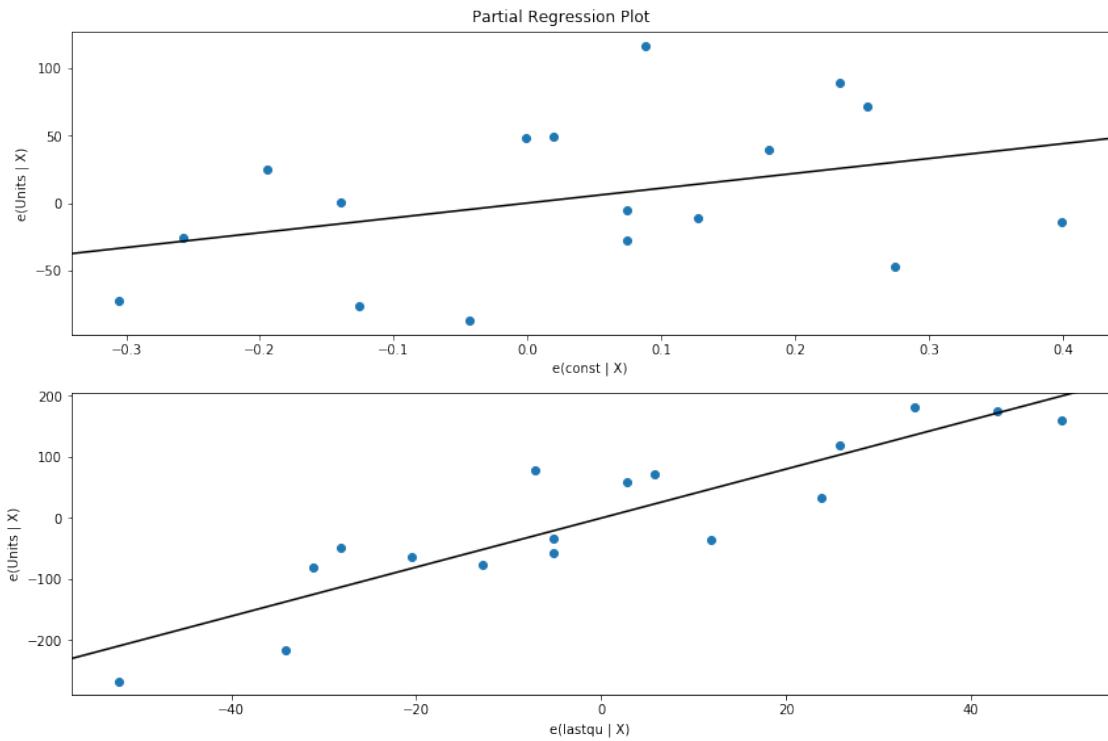
Cullman



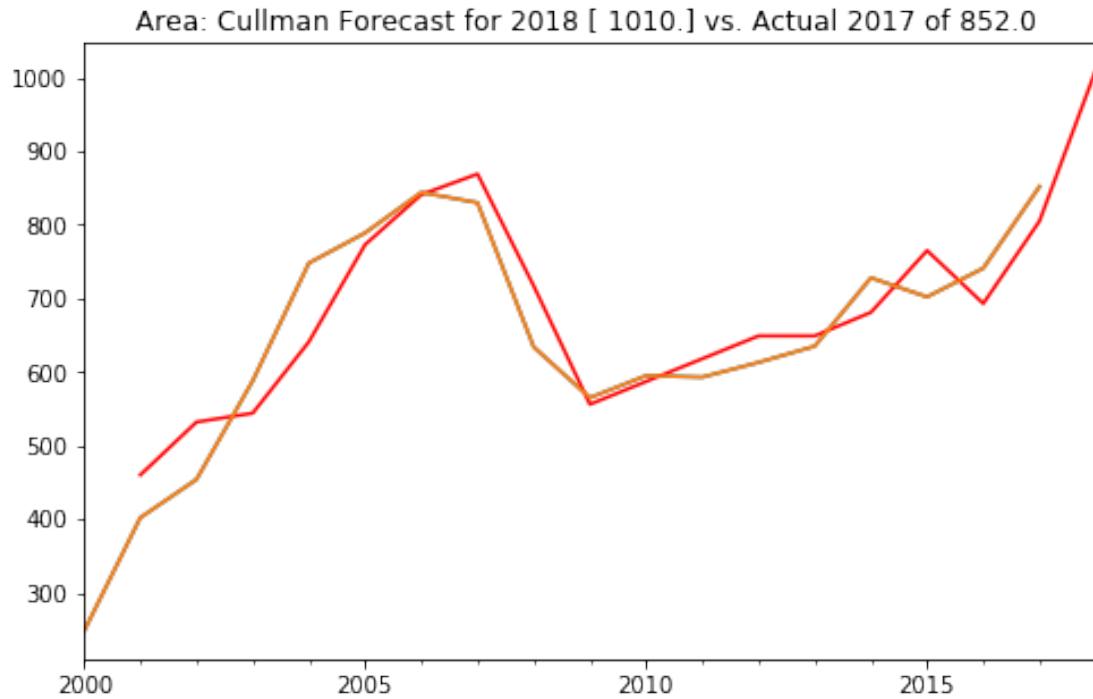
Cullman



Cullman



Cullman



'Area fcast summary: Dothan'

'Area regress: Dothan'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                               OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.641
Model:                          OLS      Adj. R-squared:            0.618
Method:                         Least Squares      F-statistic:             26.83
Date:                Mon, 29 Jan 2018      Prob (F-statistic):        0.000112
Time:                    16:56:50      Log-Likelihood:          -101.79
No. Observations:                  17      AIC:                     207.6
Df Residuals:                      15      BIC:                     209.3
Df Model:                           1
Covariance Type:            nonrobust
```

	coef	std err	t	P> t	[0.025	0.975]
const	361.6196	146.007	2.477	0.026	50.413	672.826
lastqu	3.1226	0.603	5.180	0.000	1.838	4.408
<hr/>						
Omnibus:		3.476	Durbin-Watson:		1.099	
Prob(Omnibus):		0.176	Jarque-Bera (JB):		1.275	
Skew:		0.119	Prob(JB):		0.529	
Kurtosis:		1.679	Cond. No.		1.42e+03	
<hr/>						

Warnings:

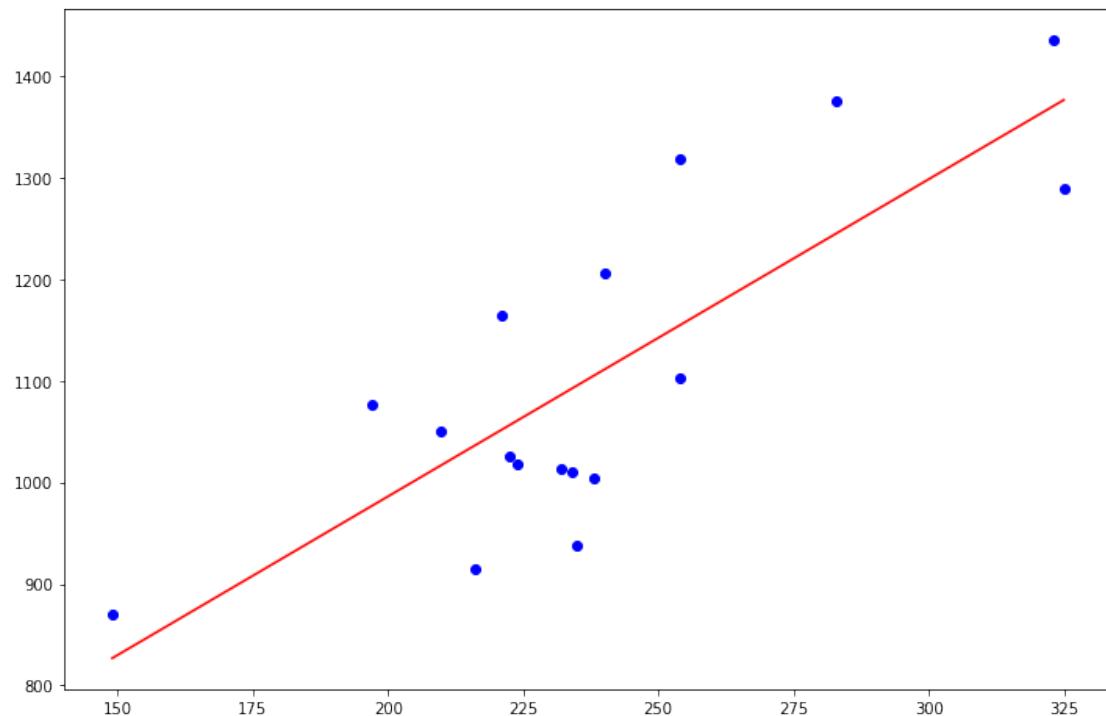
- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 1.42e+03. This might indicate that there are strong multicollinearity or other numerical problems.

"""

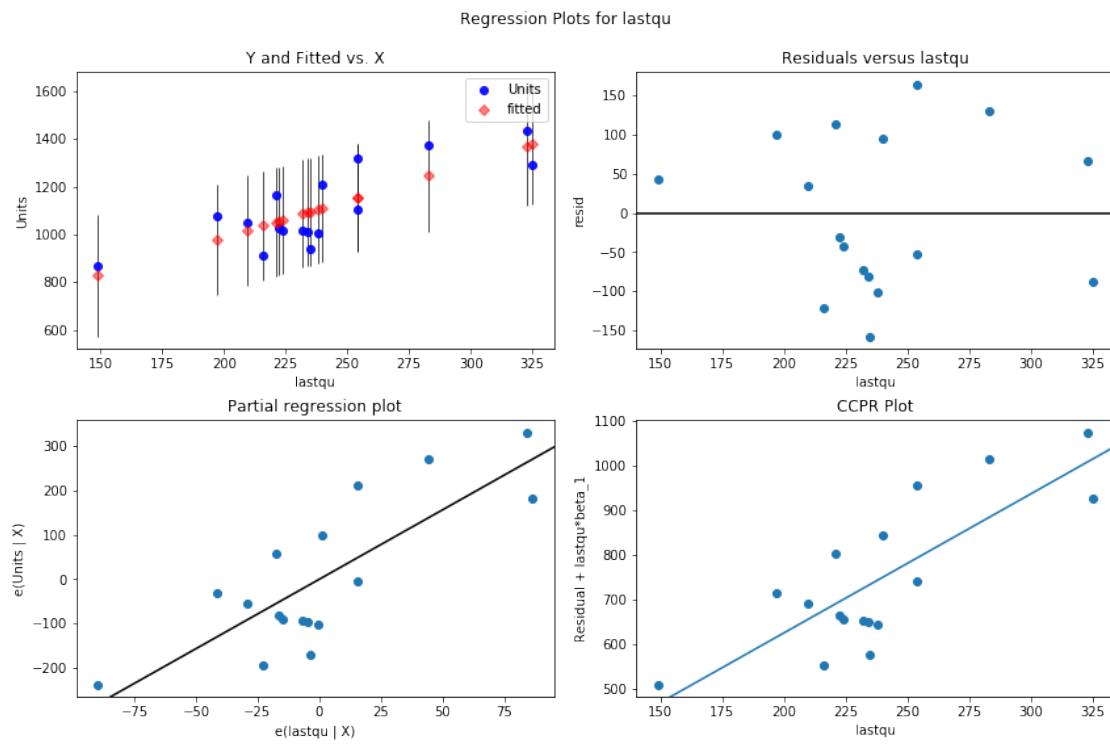
'Area Historical errors on Fcast: Dothan'

'Area mergedfcast: Dothan'

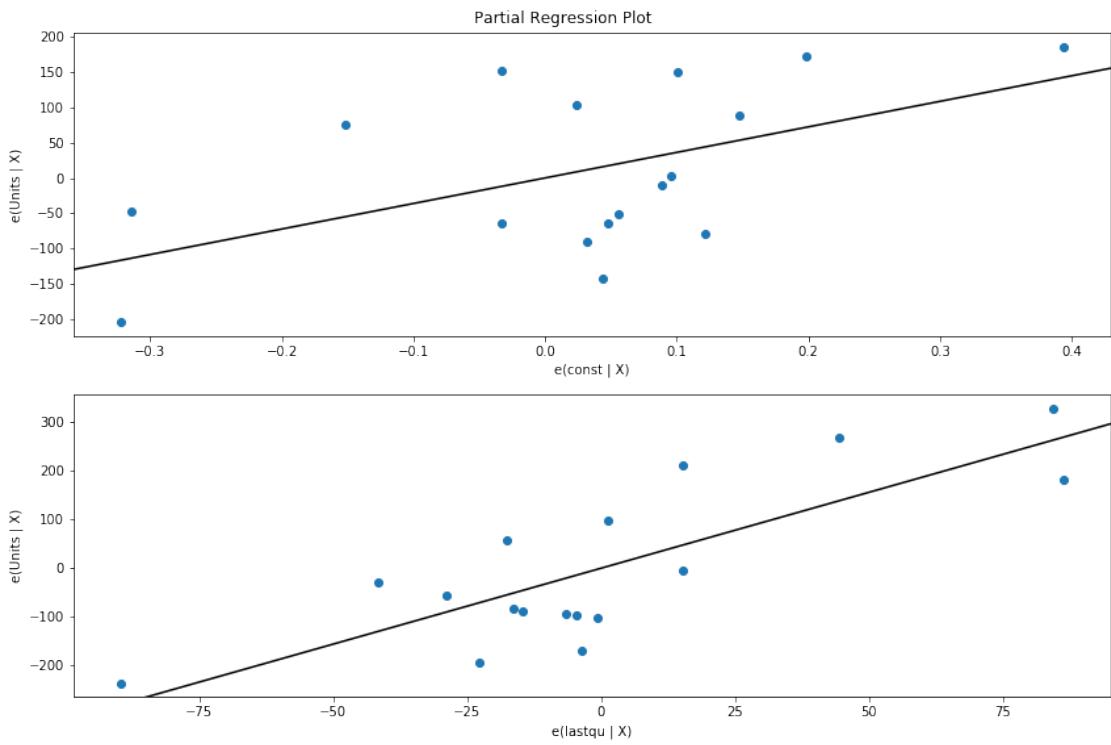
Dothan



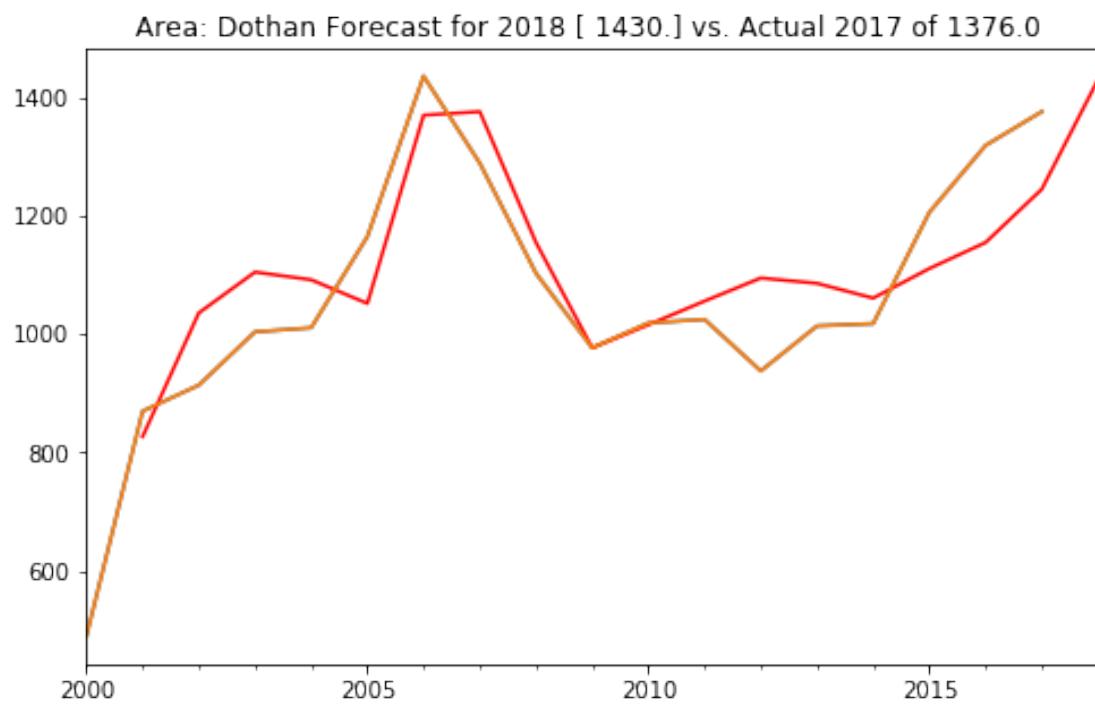
Dothan



Dothan



Dothan



```
'Area fcast summary: Gadsden'
```

```
'Area regress: Gadsden'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.667
Model:                            OLS      Adj. R-squared:             0.645
Method:                           Least Squares      F-statistic:                  30.03
Date: Mon, 29 Jan 2018      Prob (F-statistic):        6.34e-05
Time: 16:56:54      Log-Likelihood:            -97.194
No. Observations:                   17      AIC:                         198.4
Df Residuals:                      15      BIC:                         200.1
Df Model:                           1
Covariance Type:            nonrobust
=====
              coef    std err          t      P>|t|      [0.025      0.975]
-----
const      287.6947     94.817      3.034      0.008      85.598     489.791
lastqu     3.0721      0.561      5.480      0.000      1.877      4.267
=====
Omnibus:                     1.106      Durbin-Watson:           1.444
Prob(Omnibus):                 0.575      Jarque-Bera (JB):       0.703
Skew:                          0.481      Prob(JB):                  0.703
Kurtosis:                      2.736      Cond. No.                 844.
=====
```

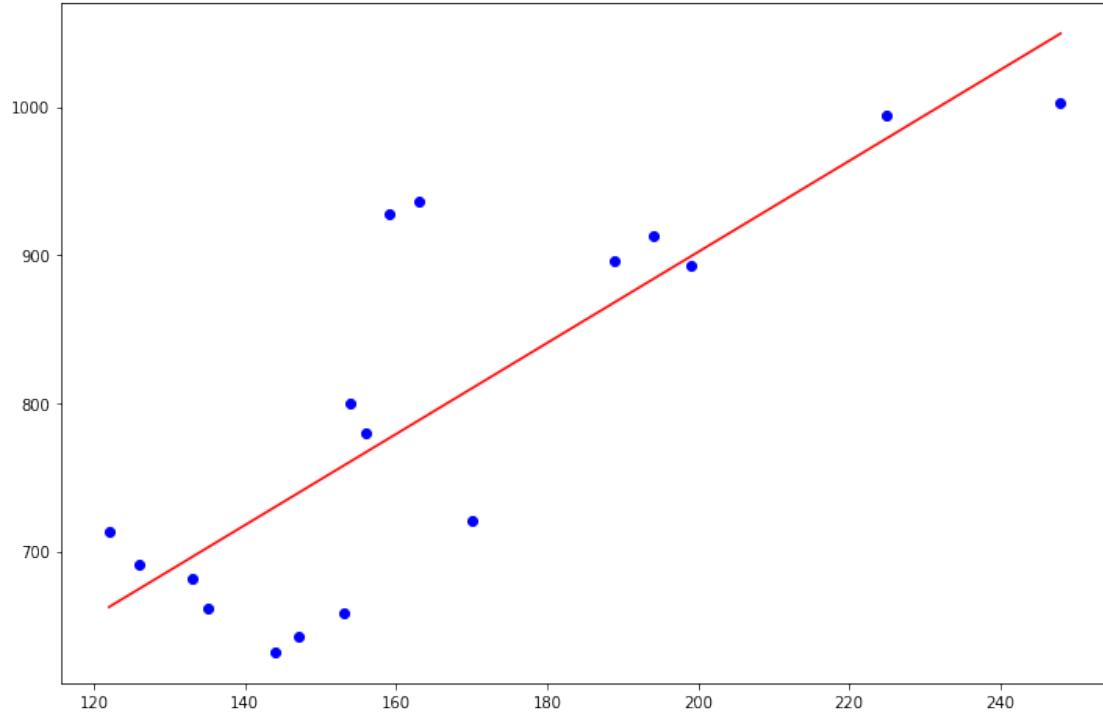
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
"""
```

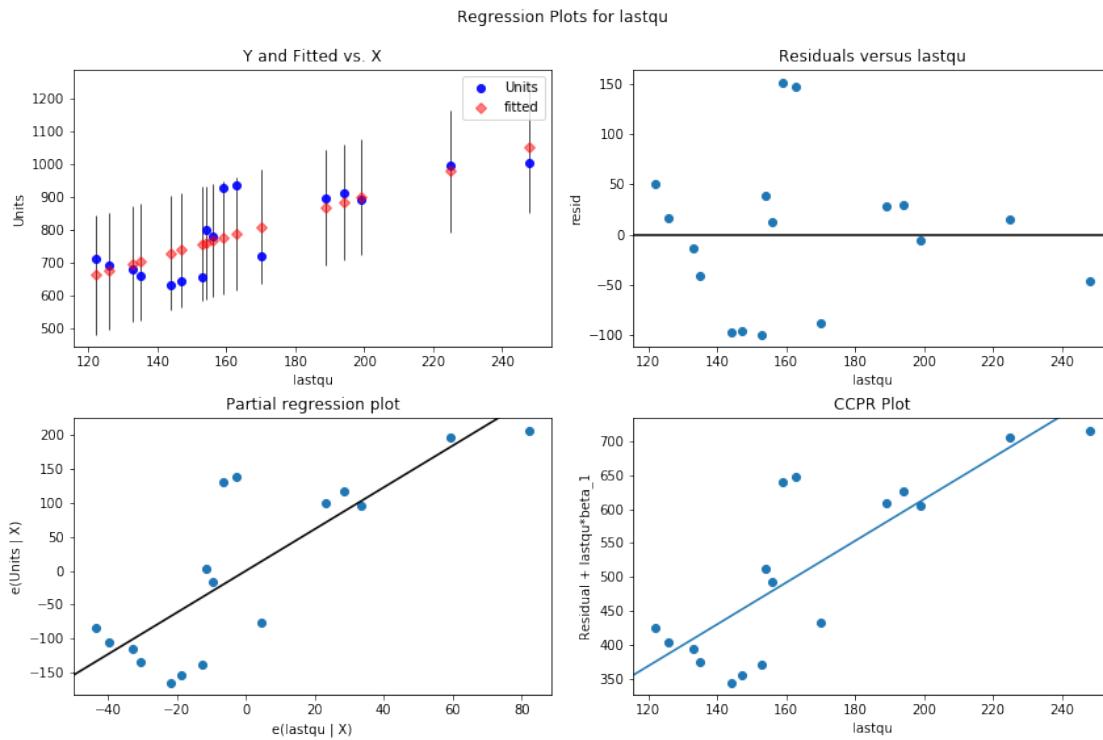
```
'Area Historical errors on Fcast: Gadsden'
```

```
'Area mergedfcast: Gadsden'
```

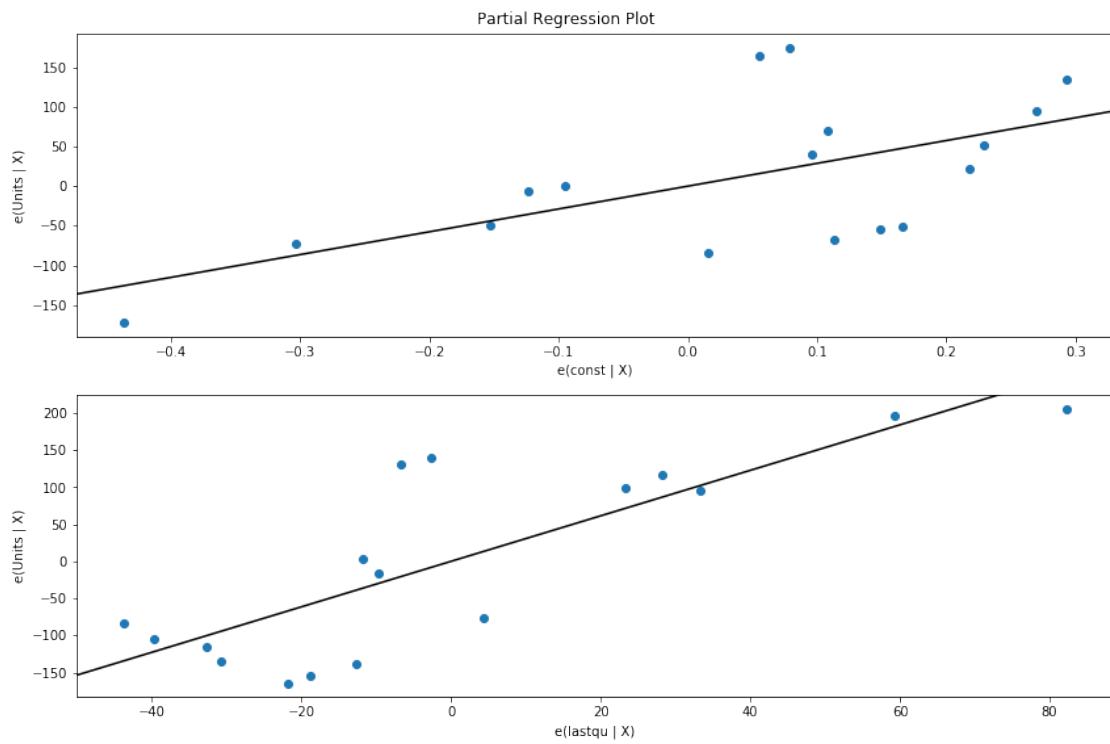
Gadsden



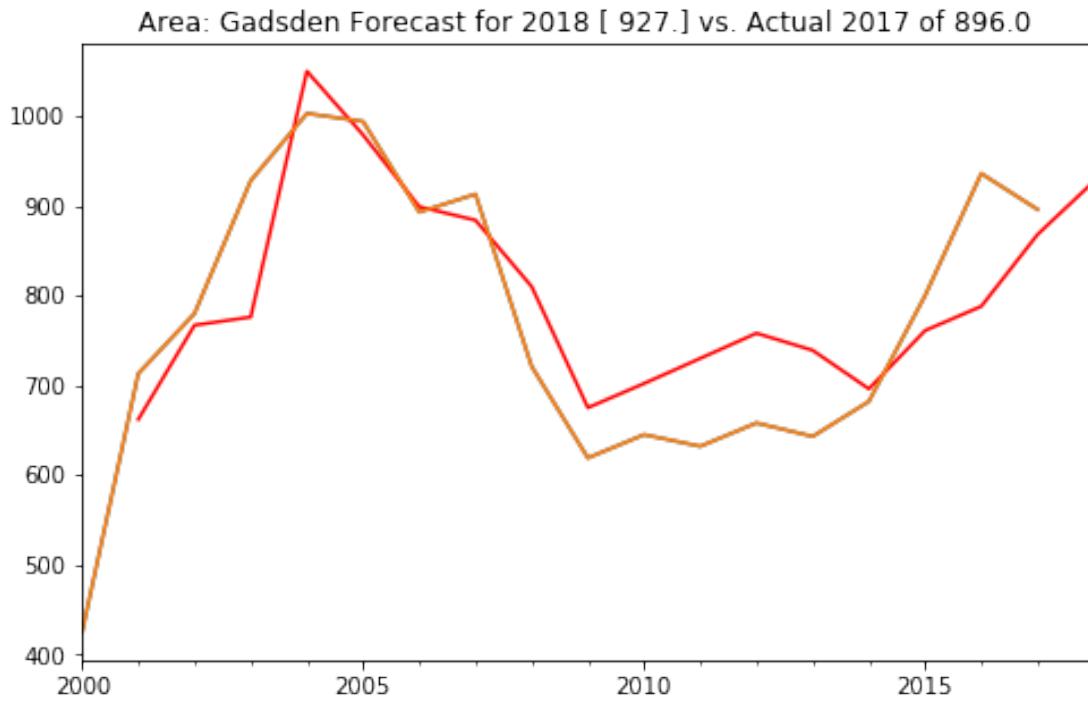
Gadsden



Gadsden



Gadsden



```
'Area fcast summary: Huntsville'
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis
    "anyway, n=%i" % int(n))
```

```
'Area regress: Huntsville'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.645
Model:                            OLS      Adj. R-squared:             0.613
Method:                          Least Squares      F-statistic:                  20.02
Date: Mon, 29 Jan 2018      Prob (F-statistic):        0.000940
Time: 16:56:58      Log-Likelihood:          -99.418
No. Observations:                   13      AIC:                         202.8
Df Residuals:                      11      BIC:                         204.0
Df Model:                           1
Covariance Type:            nonrobust
=====
```

	coef	std err	t	P> t	[0.025	0.975]
const	826.1966	1041.296	0.793	0.444	-1465.681	3118.075
lastqu	3.7946	0.848	4.474	0.001	1.928	5.661
Omnibus:			1.137	Durbin-Watson:		1.514
Prob(Omnibus):			0.566	Jarque-Bera (JB):		0.392
Skew:			-0.424	Prob(JB):		0.822
Kurtosis:			2.949	Cond. No.		8.36e+03

Warnings:

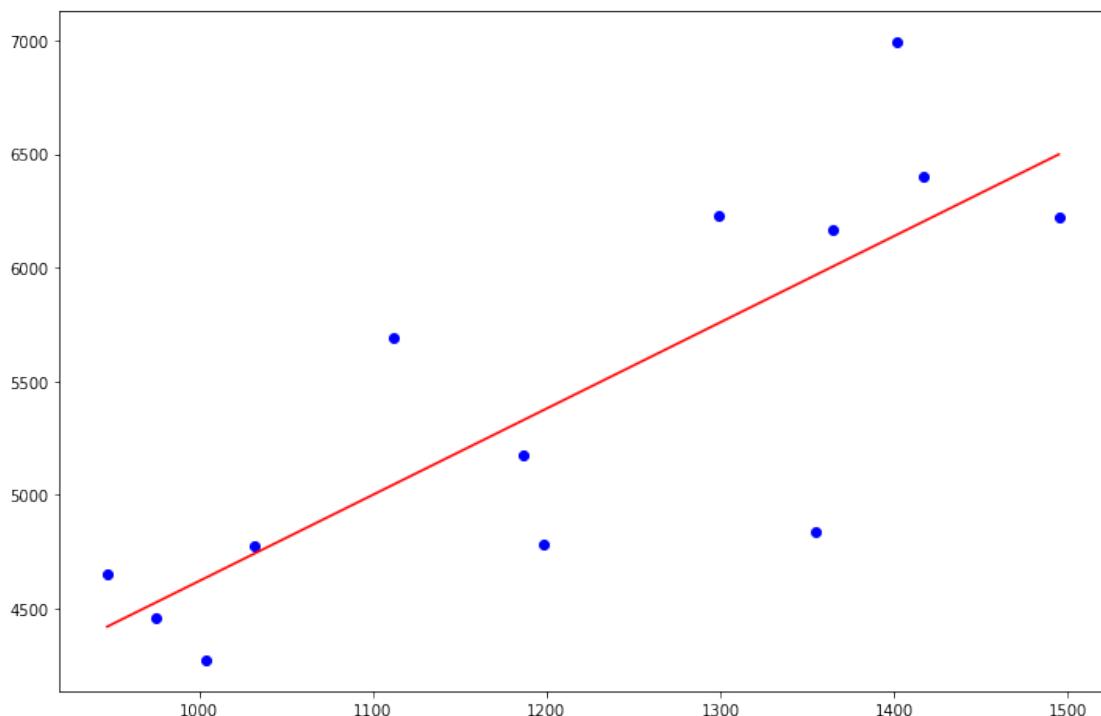
- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 8.36e+03. This might indicate that there are strong multicollinearity or other numerical problems.

"""

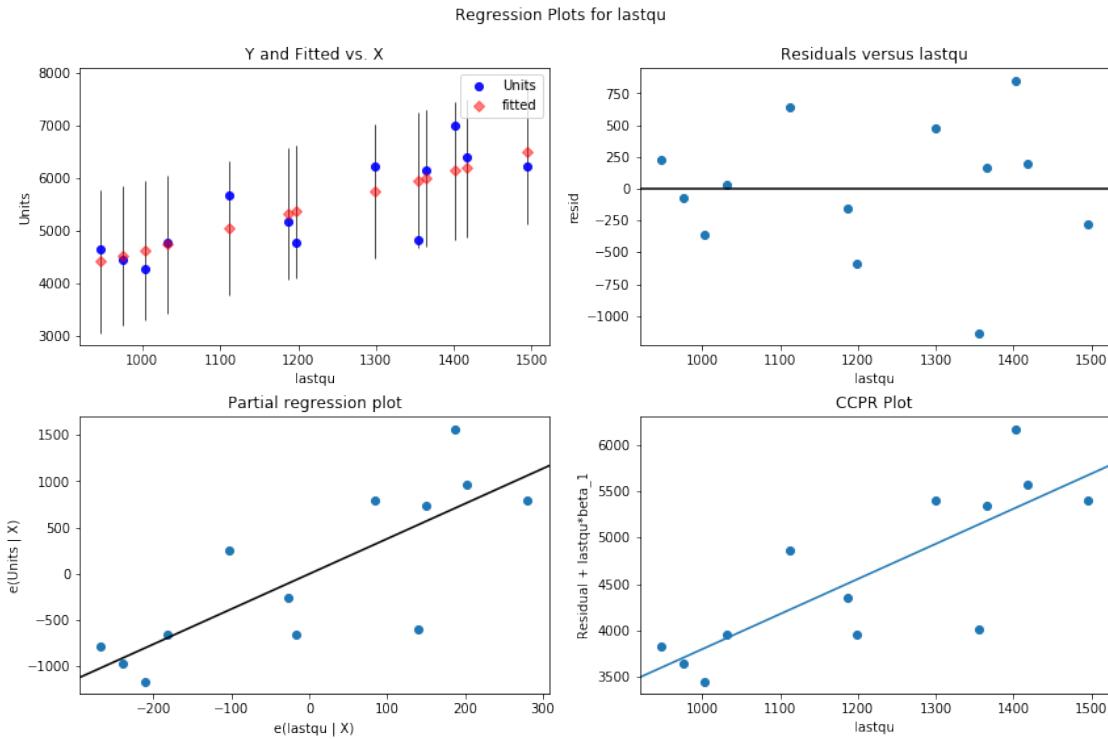
'Area Historical errors on Fcast: Huntsville'

'Area mergedfcast: Huntsville'

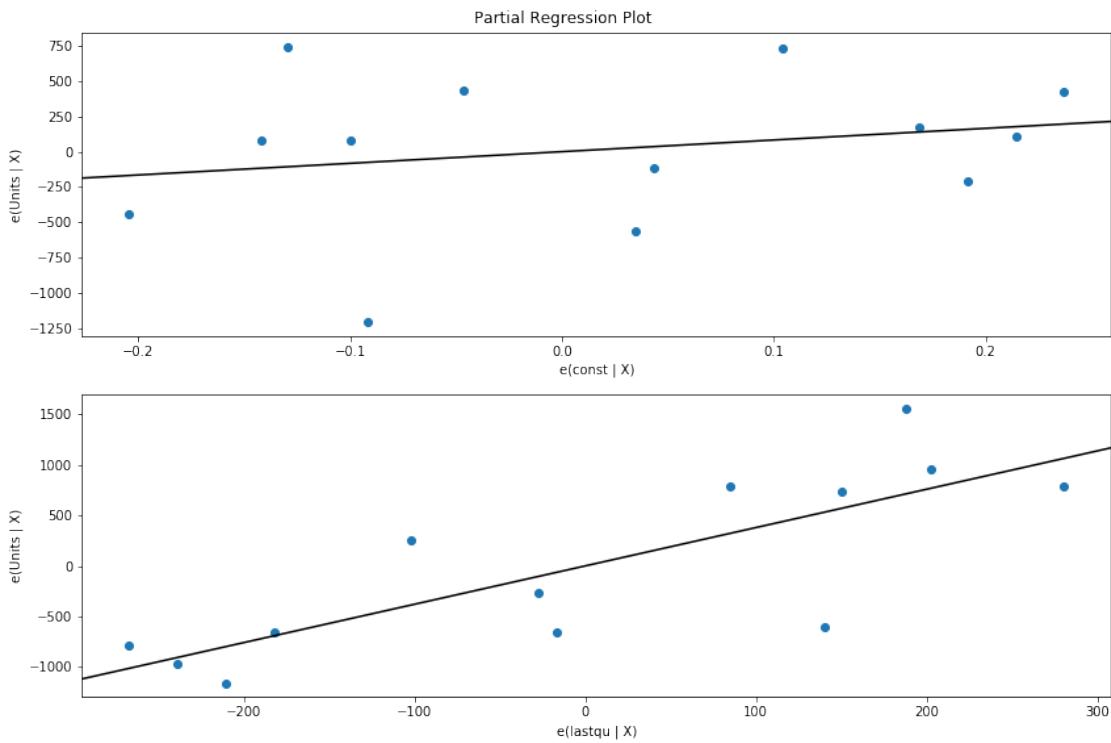
Huntsville



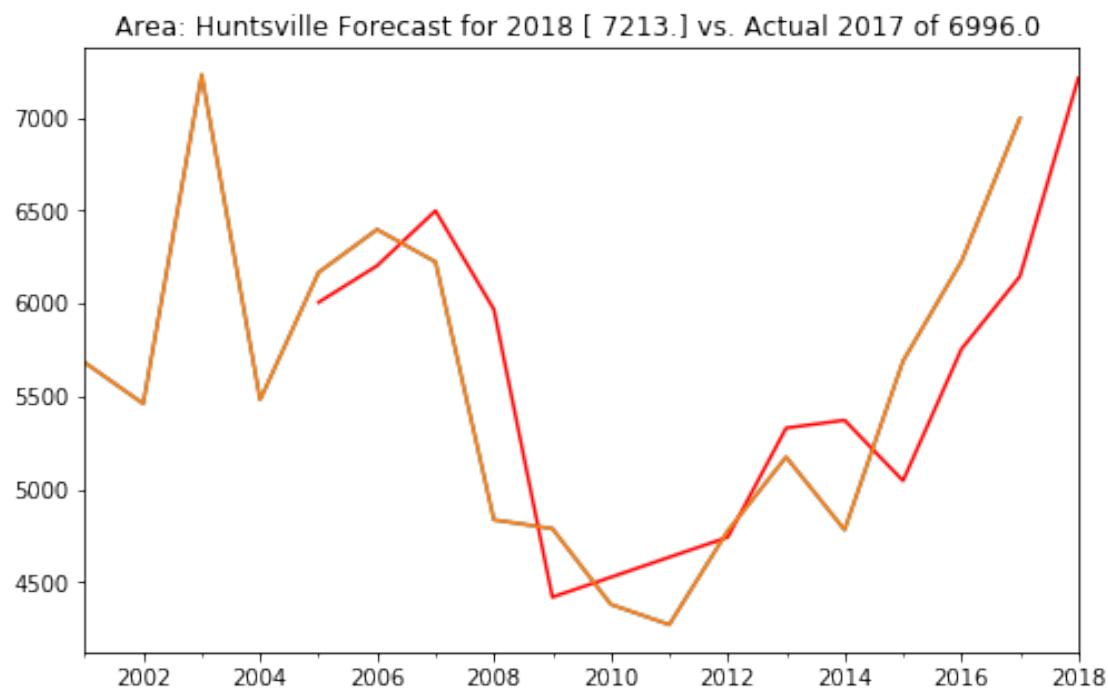
## Huntsville



## Huntsville



Huntsville



```
'Area fcast summary: Jackson'
```

```
'Area regress: Jackson'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.389
Model:                            OLS      Adj. R-squared:             0.349
Method:                           Least Squares      F-statistic:                  9.566
Date: Mon, 29 Jan 2018      Prob (F-statistic):        0.00742
Time: 16:57:02      Log-Likelihood:            -89.136
No. Observations:                   17      AIC:                         182.3
Df Residuals:                      15      BIC:                         183.9
Df Model:                           1
Covariance Type:            nonrobust
=====
              coef    std err          t      P>|t|      [0.025      0.975]
-----
const      75.7040     38.908      1.946      0.071     -7.227     158.635
lastqu     2.8495      0.921      3.093      0.007      0.886      4.813
=====
Omnibus:                      0.470      Durbin-Watson:           1.667
Prob(Omnibus):                  0.790      Jarque-Bera (JB):       0.027
Skew:                           0.097      Prob(JB):                  0.987
Kurtosis:                        3.001      Cond. No.                 139.
=====
```

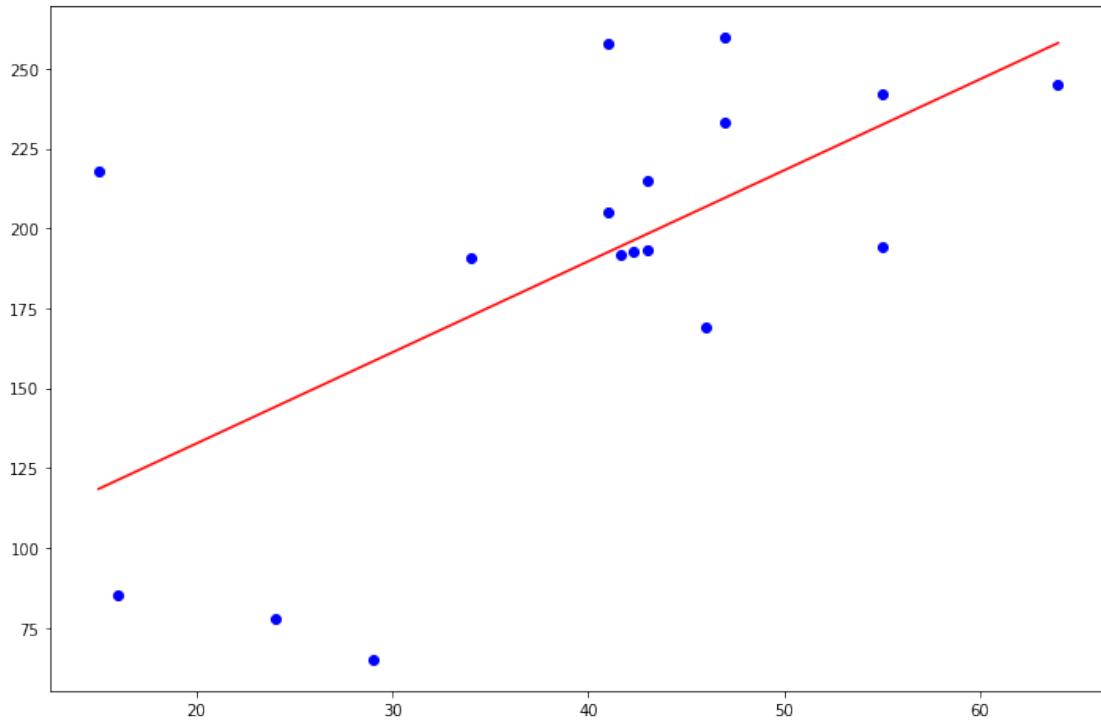
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
"""
```

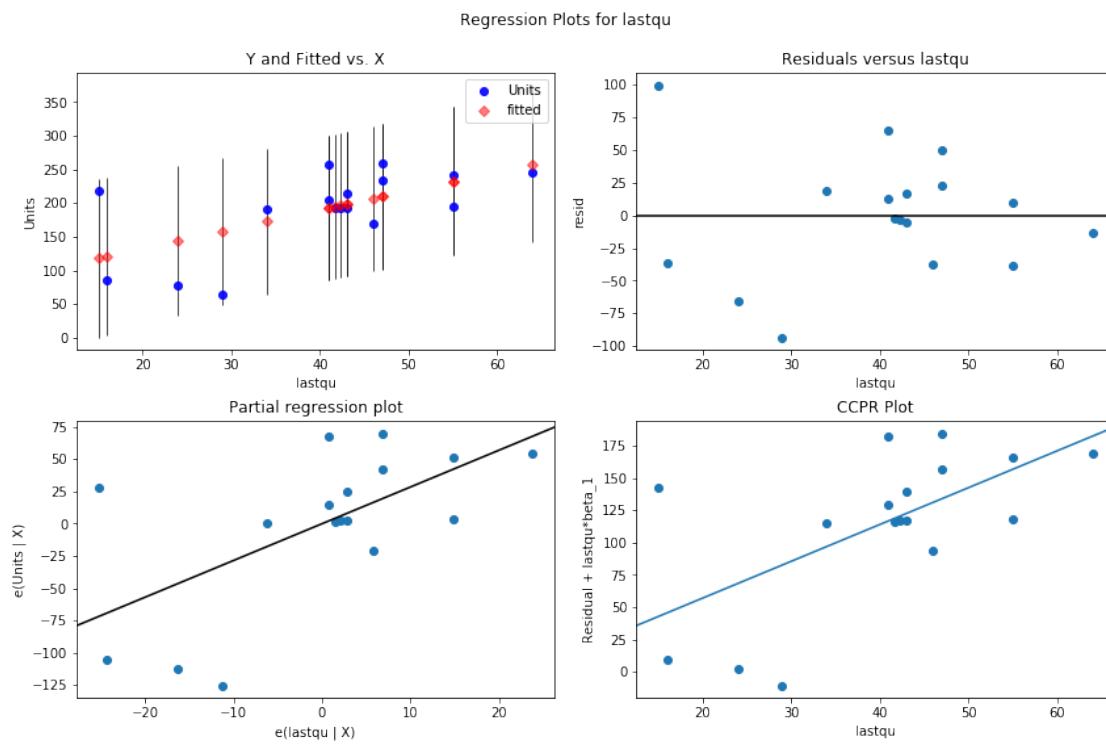
```
'Area Historical errors on Fcast: Jackson'
```

```
'Area mergedfcast: Jackson'
```

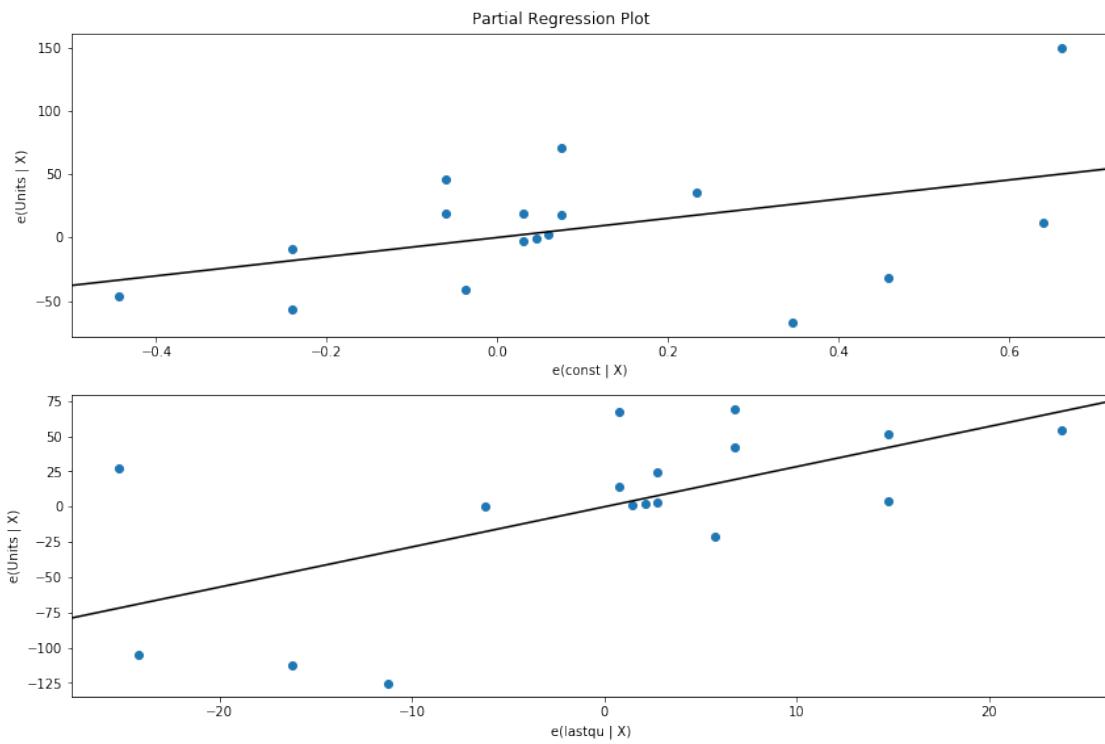
Jackson



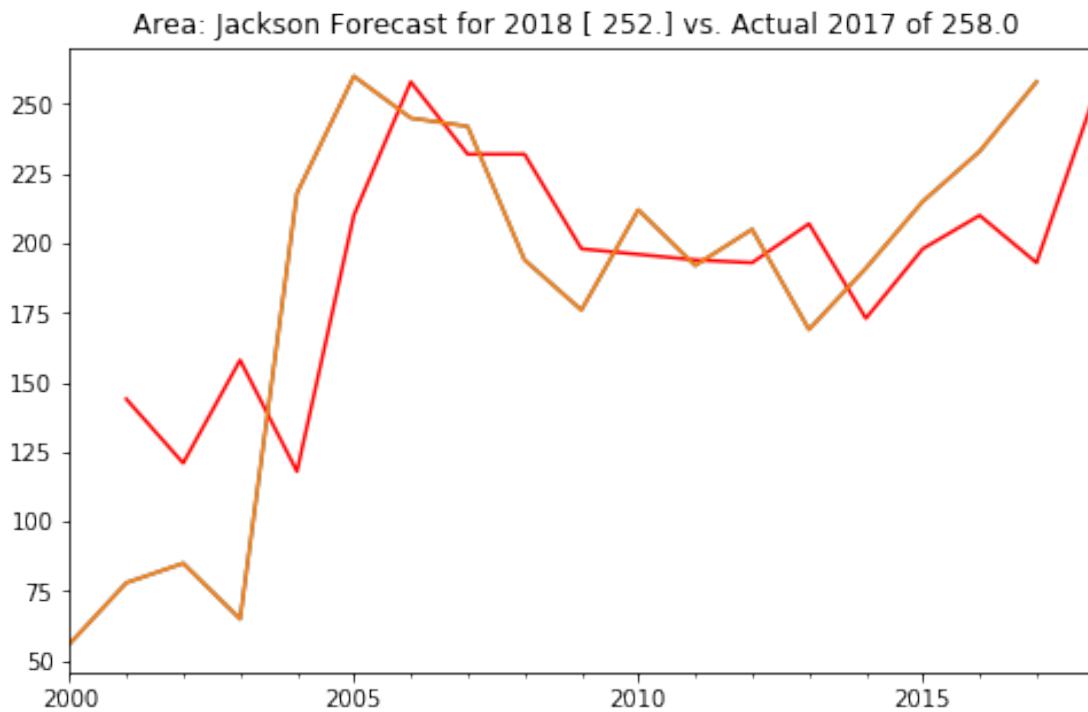
Jackson



Jackson



Jackson



```
'Area fcast summary: Lake_Martin'
```

```
'Area regress: Lake_Martin'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
=====
              OLS Regression Results
=====
Dep. Variable:                      Units
Model:                            OLS
Method:                           Least Squares
Date: Mon, 29 Jan 2018
Time: 16:57:07
No. Observations:                  17
Df Residuals:                     15
Df Model:                          1
Covariance Type:                 nonrobust
=====
            coef    std err          t      P>|t|      [0.025      0.975]
-----
const    71.8856   46.788      1.536     0.145    -27.841    171.612
lastqu   4.2266    0.554      7.631     0.000      3.046     5.407
```

```
=====
Omnibus:                      0.602   Durbin-Watson:          1.919
Prob(Omnibus):                 0.740   Jarque-Bera (JB):      0.015
Skew:                           0.052   Prob(JB):                  0.992
Kurtosis:                      3.102   Cond. No.                 308.
=====
```

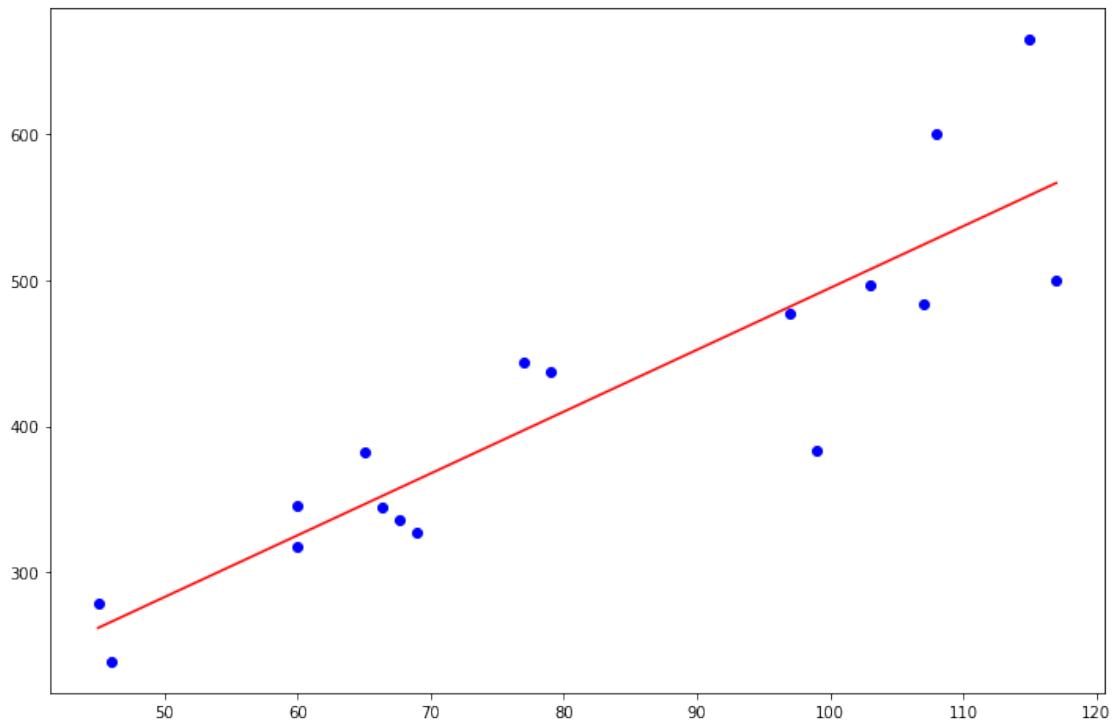
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
***
```

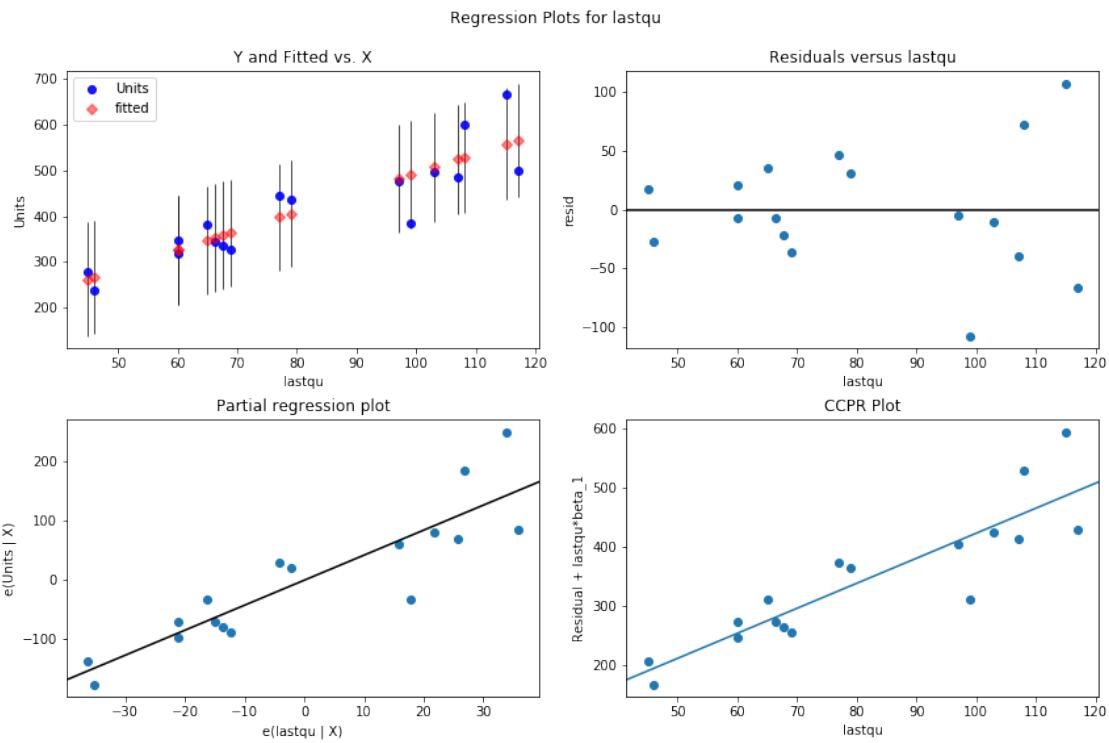
'Area Historical errors on Fcast: Lake\_Martin'

'Area mergedfcast: Lake\_Martin'

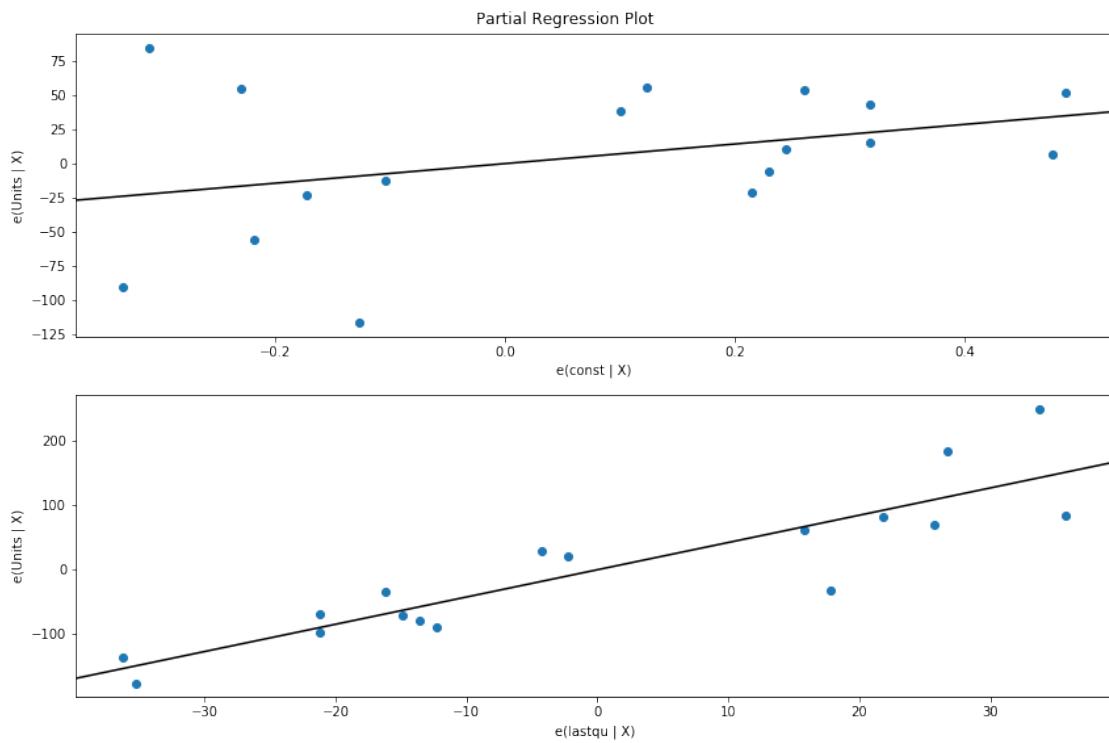
Lake\_Martin



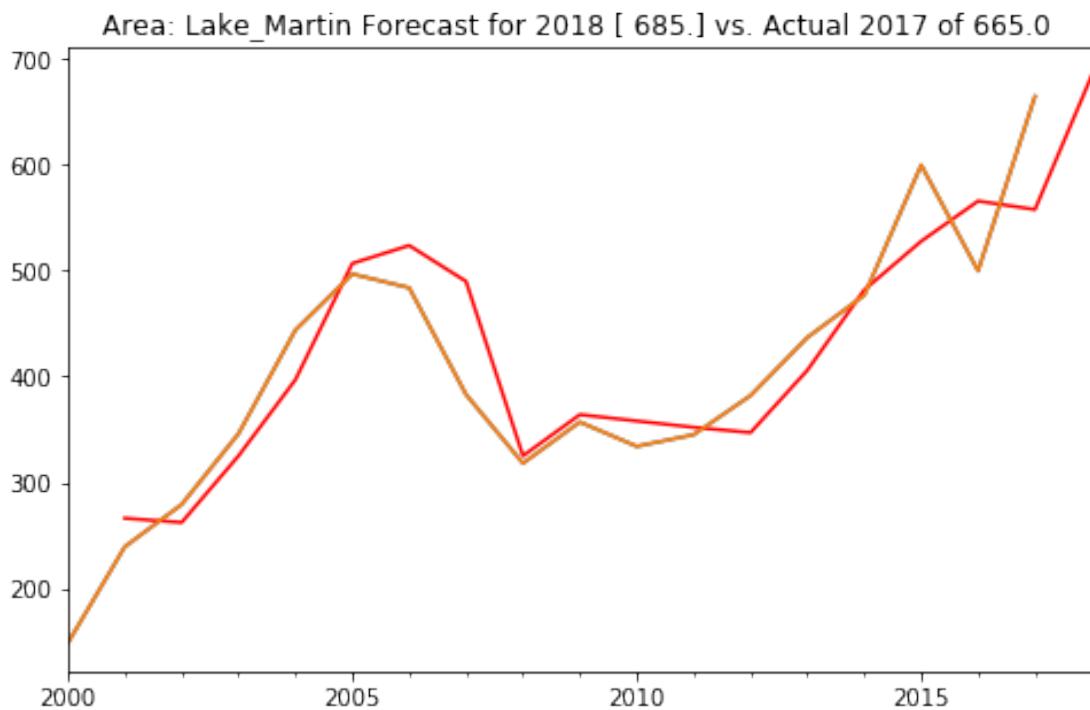
Lake\_Martin



### Lake\_Martin



Lake\_Martin



'Area fcast summary: Lee'

'Area regress: Lee'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
=====
          OLS Regression Results
=====
Dep. Variable:                  Units      R-squared:     0.853
Model:                          OLS      Adj. R-squared:  0.843
Method:                         Least Squares      F-statistic:   87.19
Date: Mon, 29 Jan 2018      Prob (F-statistic):  1.22e-07
Time: 16:57:12                  Log-Likelihood: -104.05
No. Observations:                 17                  AIC:         212.1
Df Residuals:                      15                  BIC:         213.8
Df Model:                           1
Covariance Type:            nonrobust
```

	coef	std err	t	P> t	[0.025	0.975]
const	264.2737	113.803	2.322	0.035	21.709	506.838
lastqu	4.5314	0.485	9.337	0.000	3.497	5.566
<hr/>						
Omnibus:		0.093	Durbin-Watson:		1.737	
Prob(Omnibus):		0.955	Jarque-Bera (JB):		0.308	
Skew:		0.091	Prob(JB):		0.857	
Kurtosis:		2.366	Cond. No.		938.	
<hr/>						

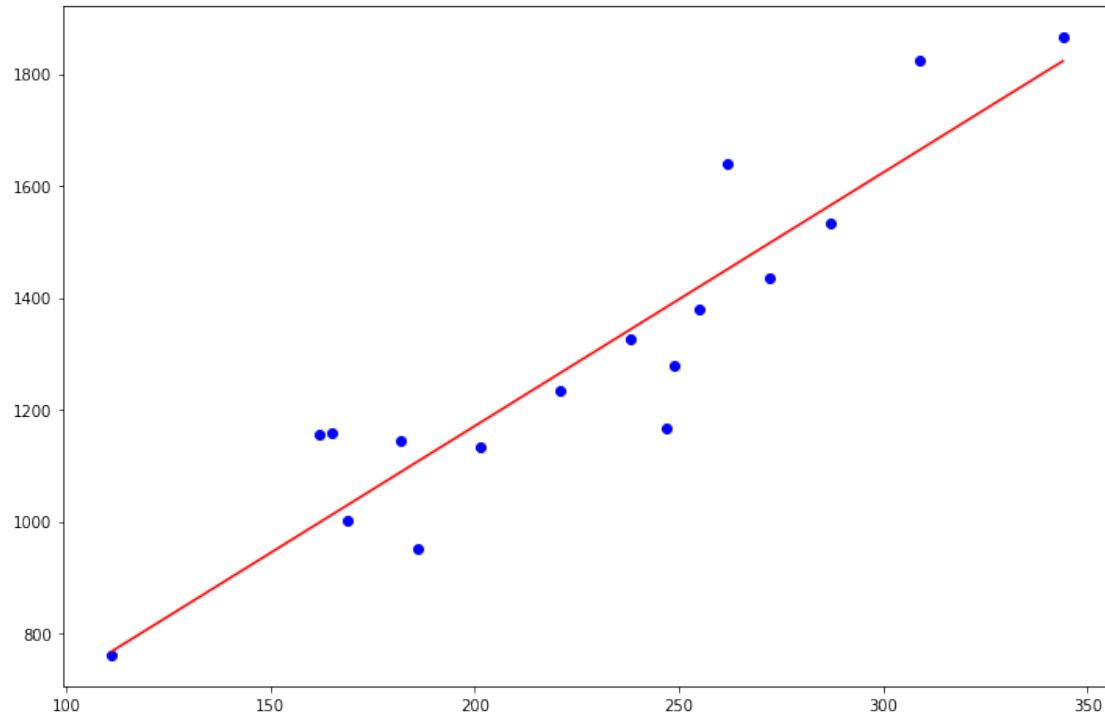
Warnings:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
"""

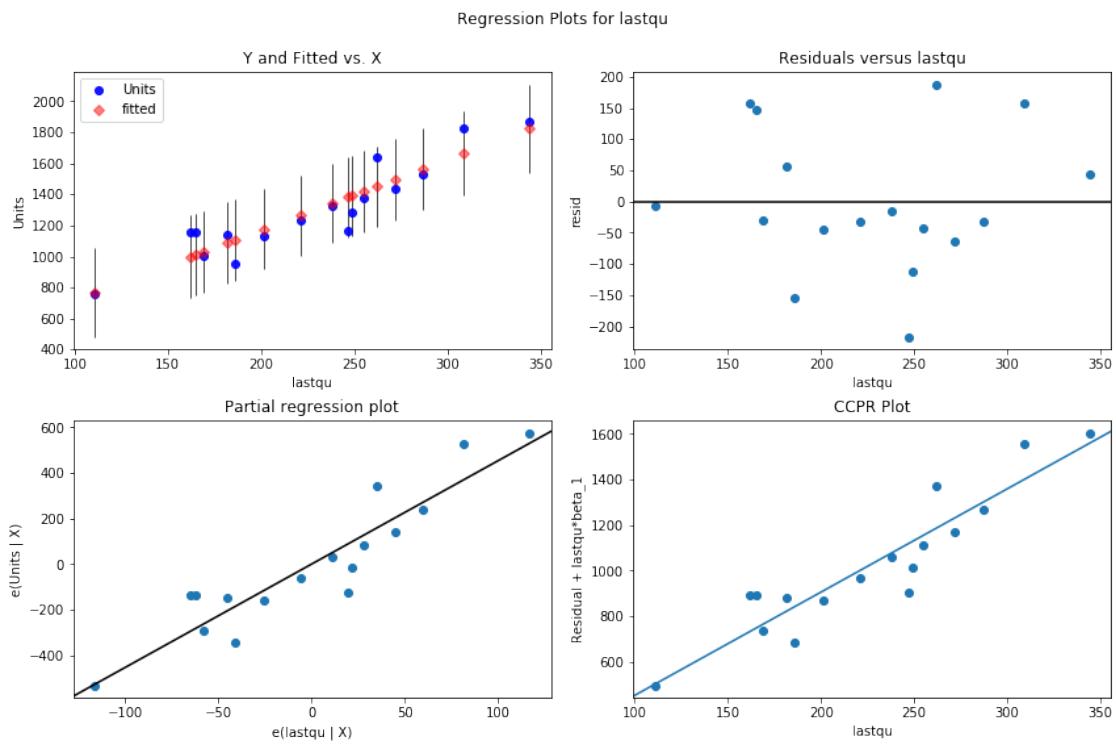
'Area Historical errors on Fcast: Lee'

'Area mergedfcast: Lee'

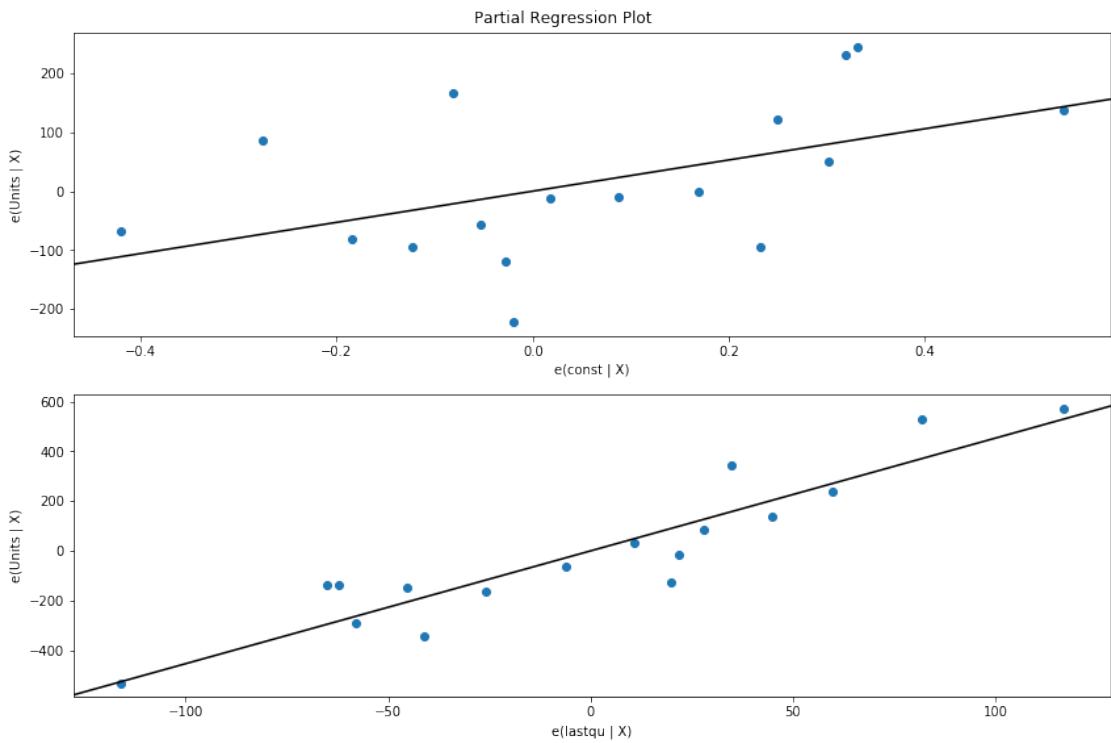
Lee



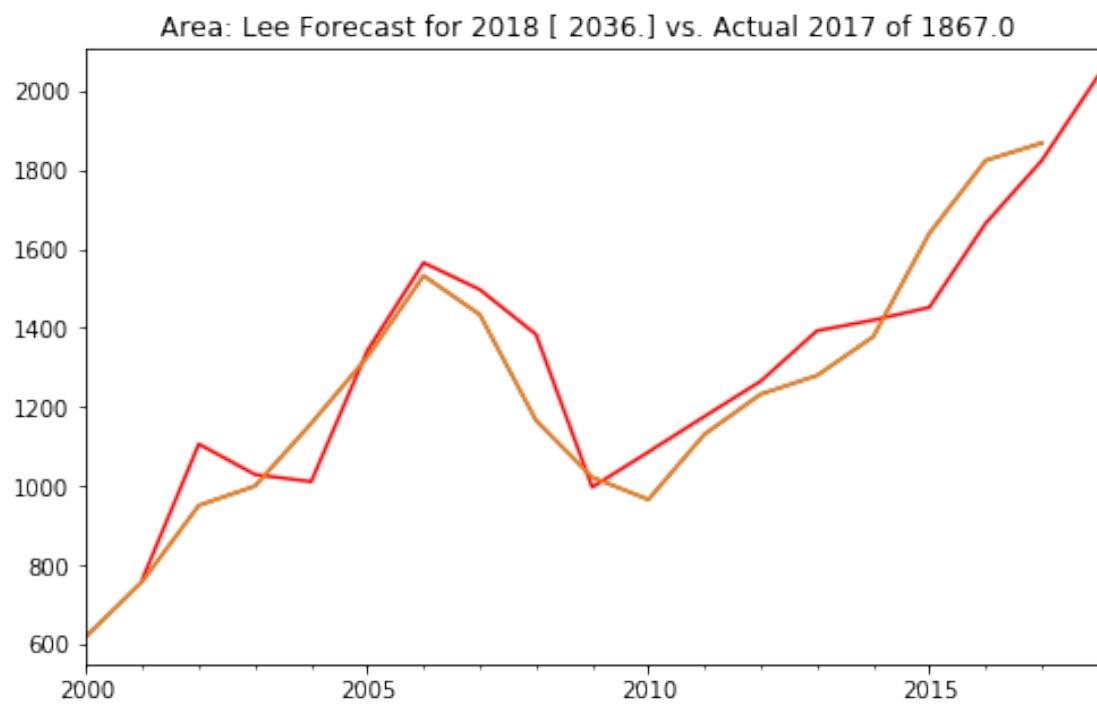
Lee



Lee



Lee



```
'Area fcast summary: Marshall'
```

```
'Area regress: Marshall'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.849
Model:                            OLS      Adj. R-squared:             0.839
Method:                           Least Squares      F-statistic:                  84.16
Date: Mon, 29 Jan 2018      Prob (F-statistic):        1.53e-07
Time: 16:57:16      Log-Likelihood:            -94.624
No. Observations:                   17      AIC:                         193.2
Df Residuals:                      15      BIC:                         194.9
Df Model:                           1
Covariance Type:            nonrobust
=====
            coef    std err          t      P>|t|      [0.025      0.975]
-----
const    199.8659     74.475      2.684      0.017     41.126    358.606
lastqu    3.3498     0.365      9.174      0.000      2.572      4.128
=====
Omnibus:                      0.628      Durbin-Watson:            2.734
Prob(Omnibus):                  0.730      Jarque-Bera (JB):        0.651
Skew:                          -0.223      Prob(JB):                  0.722
Kurtosis:                      2.152      Cond. No.                 930.
=====
```

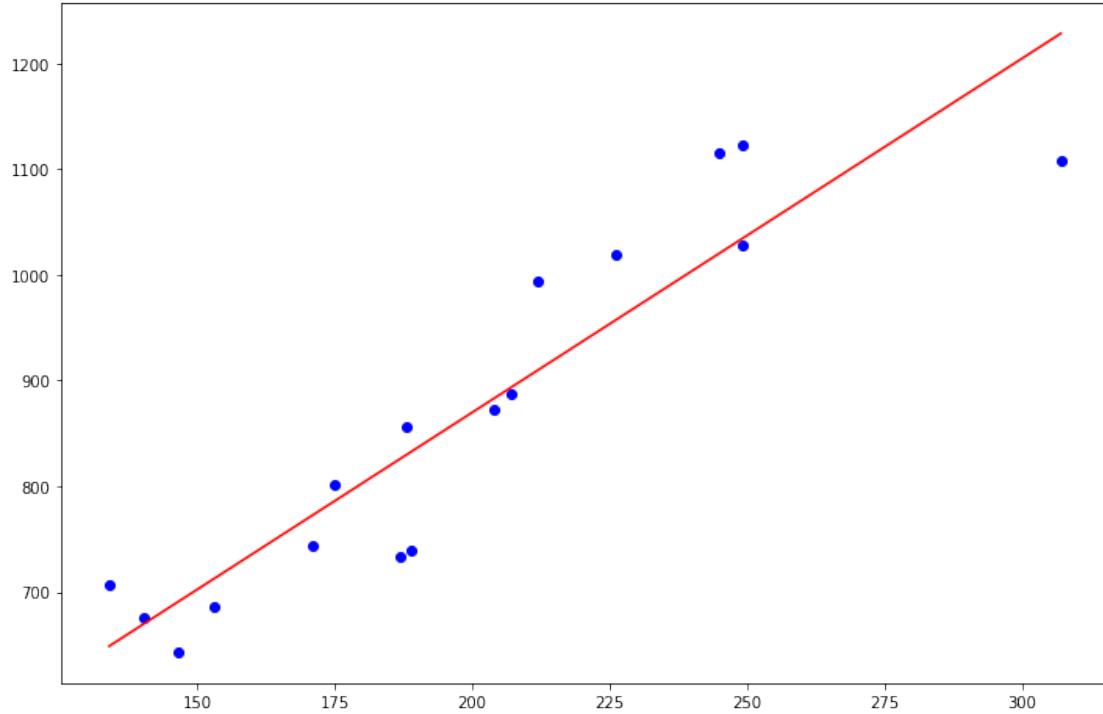
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
"""
```

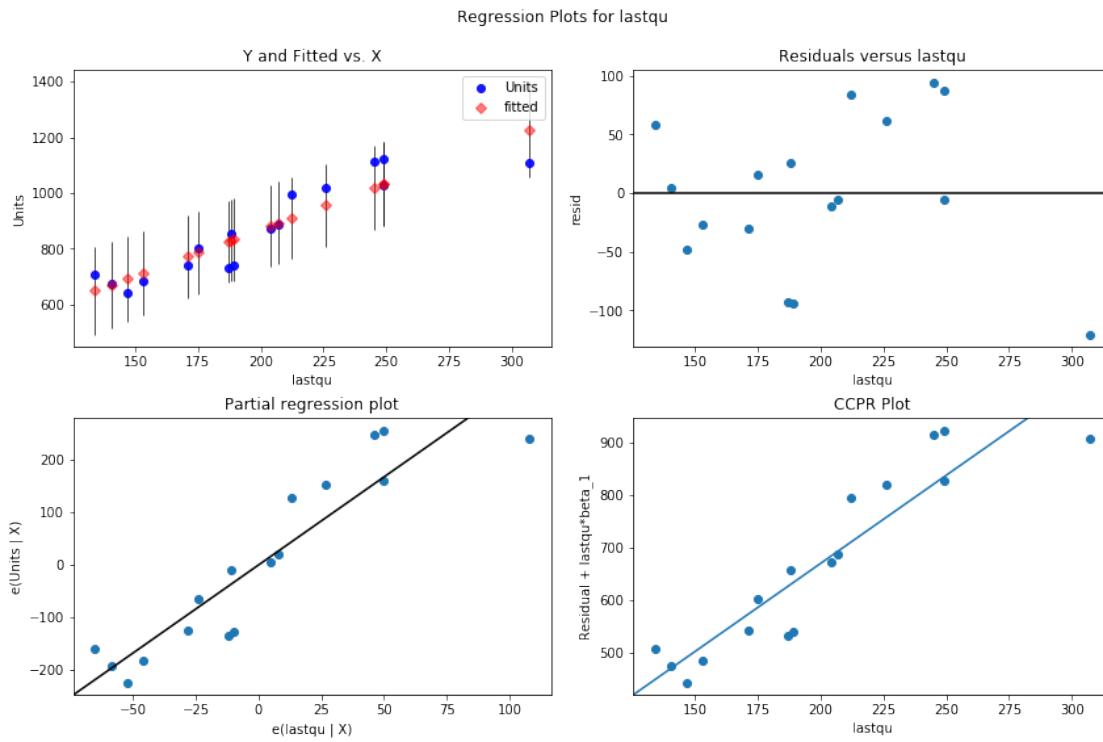
```
'Area Historical errors on Fcast: Marshall'
```

```
'Area mergedfcast: Marshall'
```

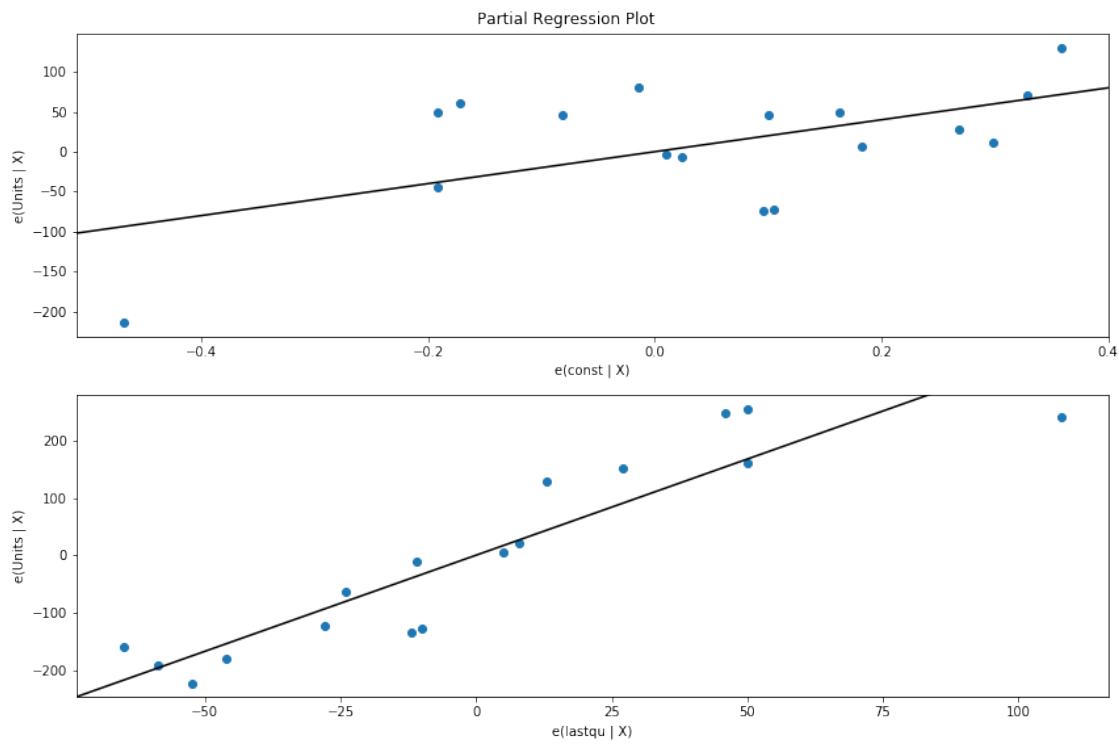
Marshall



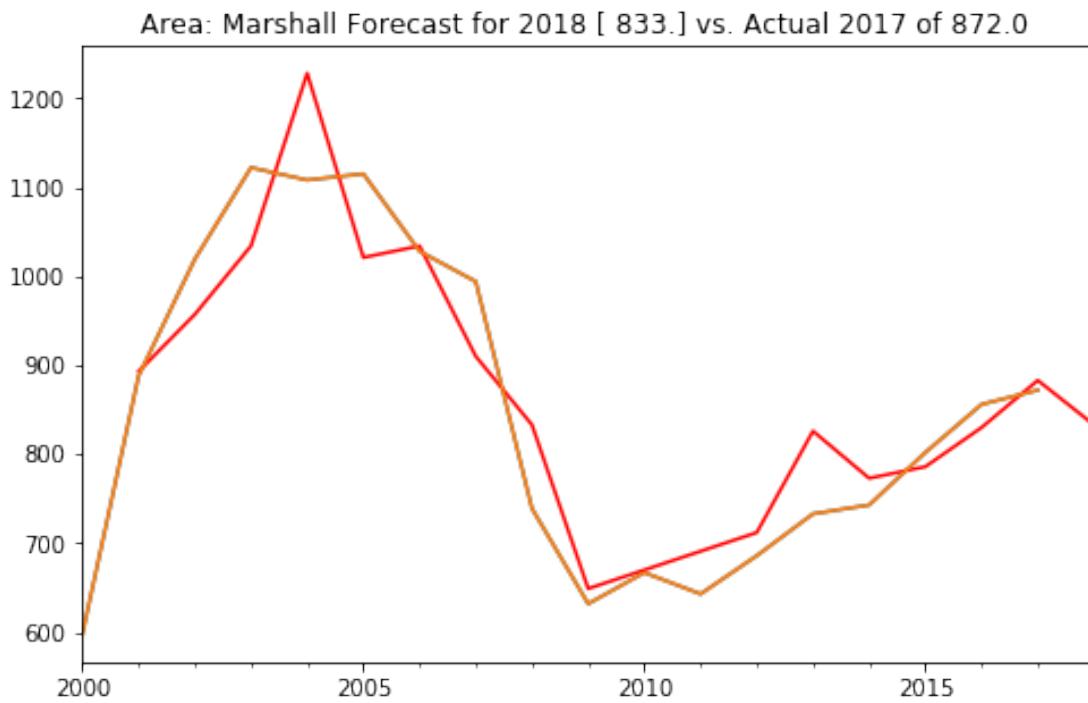
Marshall



Marshall



Marshall



```
'Area fcast summary: Mobile'
```

```
'Area regress: Mobile'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.675
Model:                            OLS      Adj. R-squared:            0.653
Method:                           Least Squares      F-statistic:             31.10
Date:                            Mon, 29 Jan 2018      Prob (F-statistic):      5.29e-05
Time:                             16:57:18      Log-Likelihood:          -132.20
No. Observations:                  17      AIC:                     268.4
Df Residuals:                      15      BIC:                     270.1
Df Model:                           1
Covariance Type:                nonrobust
=====
              coef    std err        t      P>|t|      [0.025      0.975]
-----
const      1509.3333   564.415     2.674     0.017     306.311    2712.355
lastqu     2.9818     0.535     5.577     0.000      1.842     4.121
```

```
=====
Omnibus:           1.690   Durbin-Watson:        2.003
Prob(Omnibus):    0.429   Jarque-Bera (JB):    0.312
Skew:              0.052   Prob(JB):            0.856
Kurtosis:          3.655   Cond. No.           4.00e+03
=====
```

Warnings:

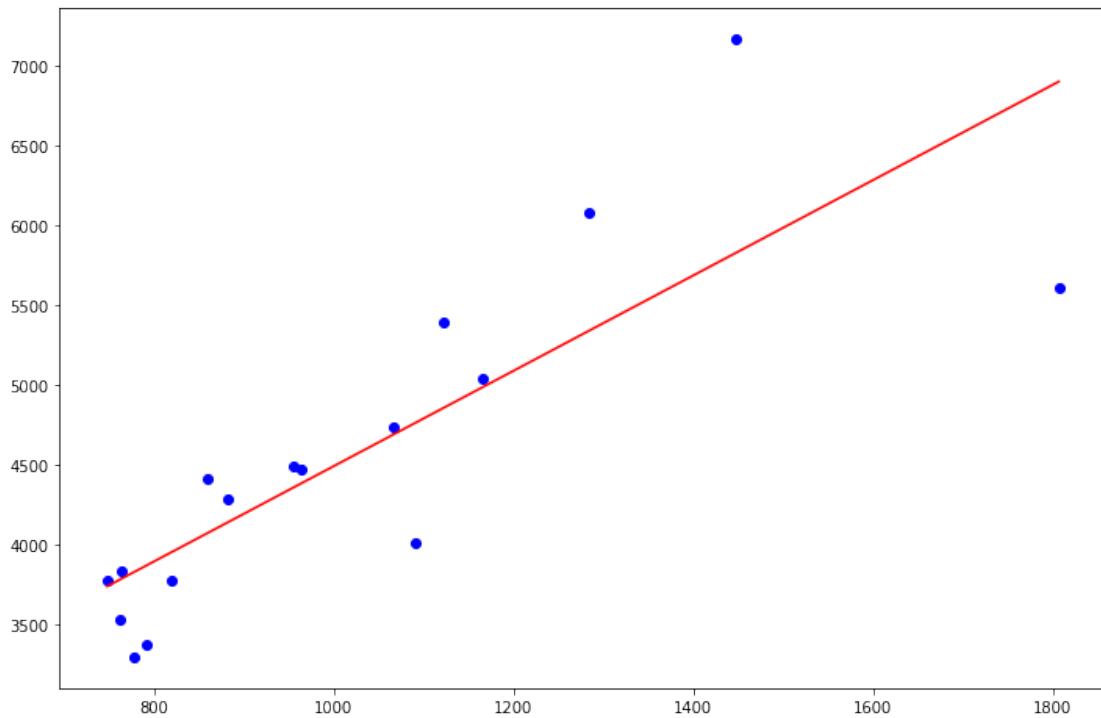
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
[2] The condition number is large, 4e+03. This might indicate that there are  
strong multicollinearity or other numerical problems.

"""

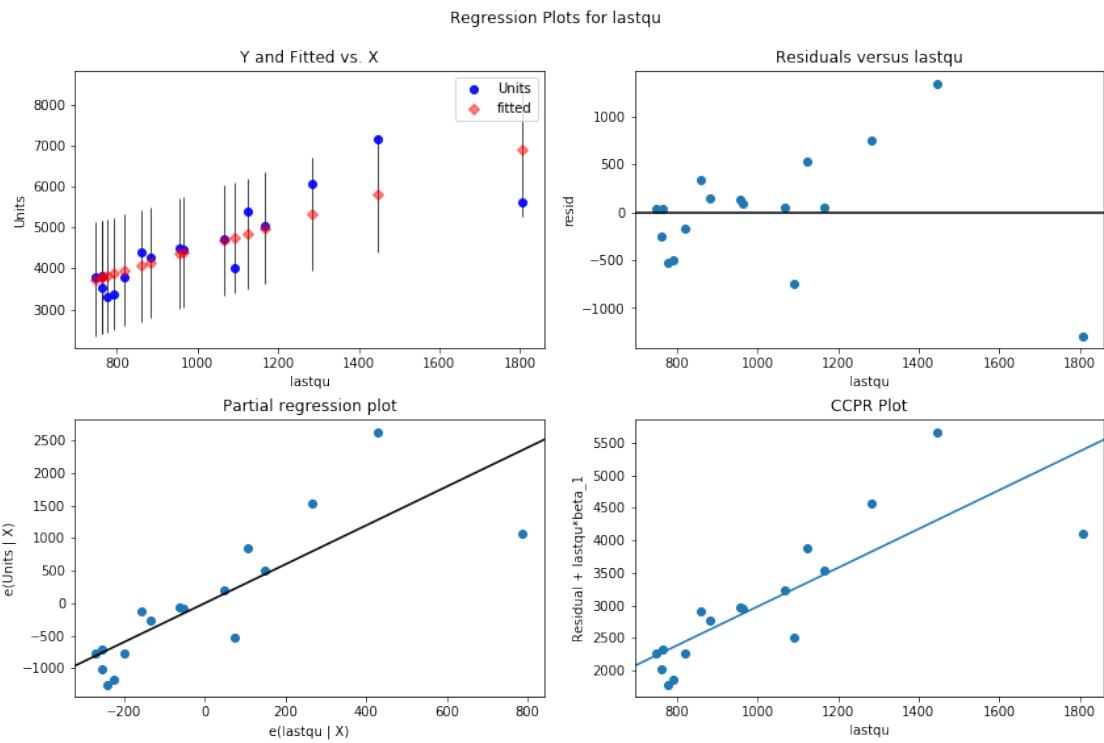
'Area Historical errors on Fcast: Mobile'

'Area mergedfcast: Mobile'

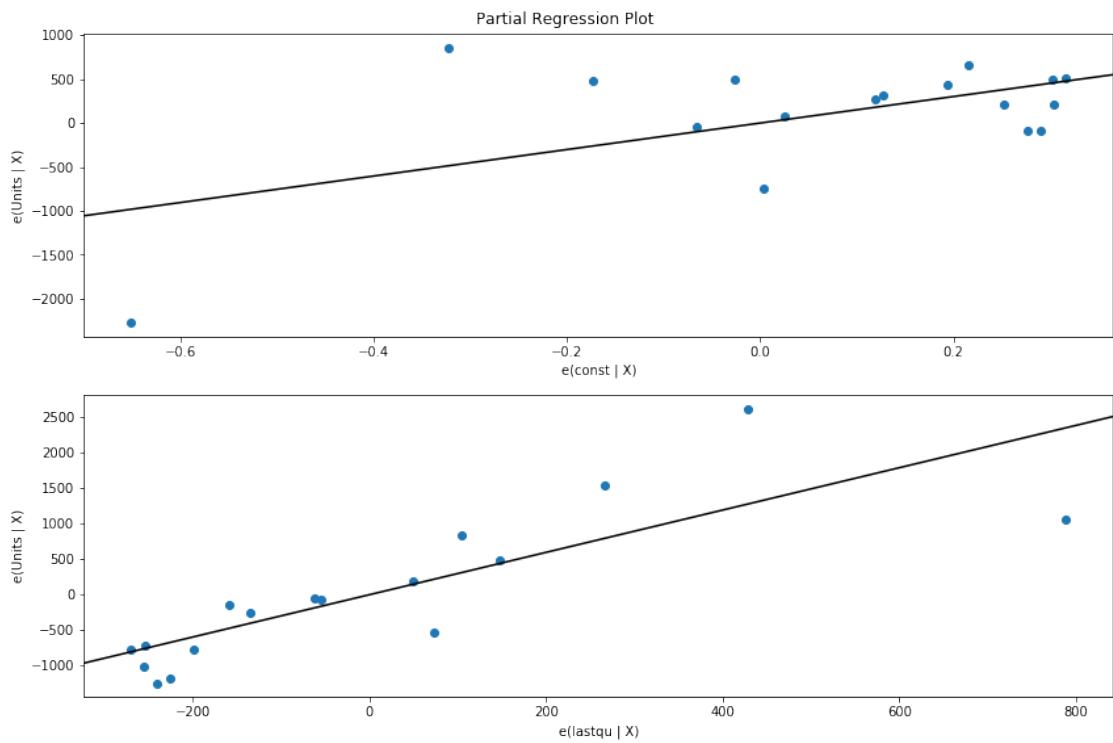
Mobile



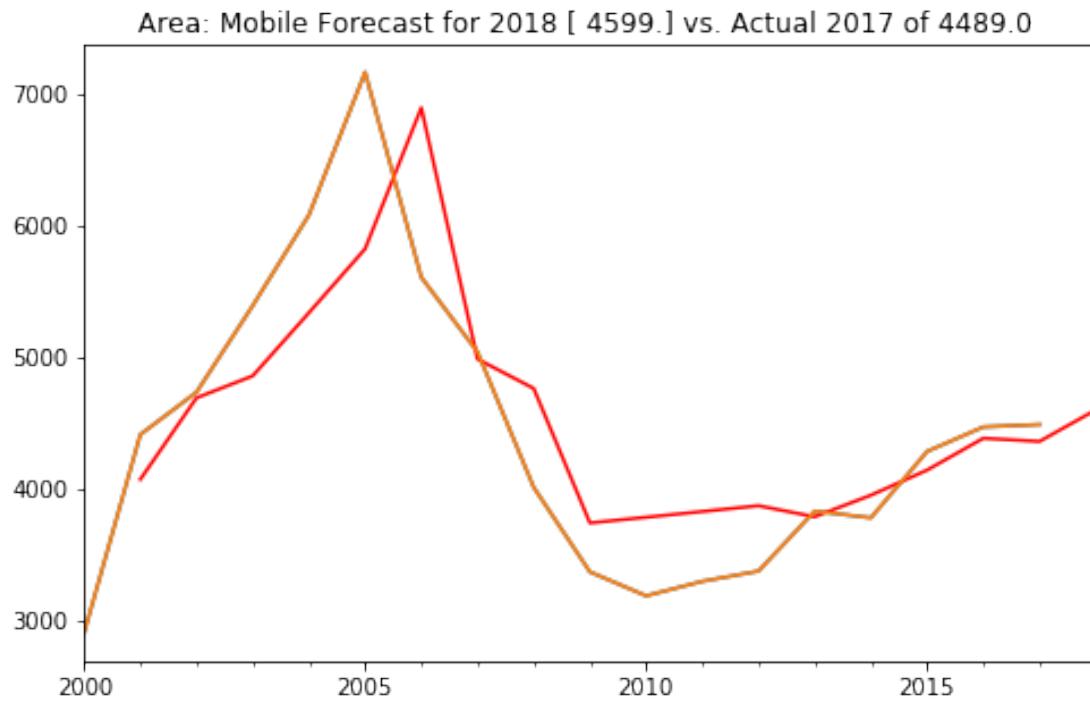
Mobile



## Mobile



Mobile



'Area fcast summary: Monroe'

'Area regress: Monroe'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
=====
          OLS Regression Results
=====
Dep. Variable:                  Units      R-squared:     0.329
Model:                          OLS      Adj. R-squared:  0.284
Method:                         Least Squares   F-statistic:   7.343
Date: Mon, 29 Jan 2018            Prob (F-statistic):  0.0161
Time: 16:57:20                   Log-Likelihood: -70.619
No. Observations:                 17        AIC:             145.2
Df Residuals:                      15        BIC:             146.9
Df Model:                           1
Covariance Type:            nonrobust
```

	coef	std err	t	P> t	[0.025	0.975]
const	55.2136	15.926	3.467	0.003	21.268	89.159
lastqu	1.8356	0.677	2.710	0.016	0.392	3.279
<hr/>						
Omnibus:		3.771	Durbin-Watson:		1.831	
Prob(Omnibus):		0.152	Jarque-Bera (JB):		1.601	
Skew:		-0.592	Prob(JB):		0.449	
Kurtosis:		3.927	Cond. No.		94.3	
<hr/>						

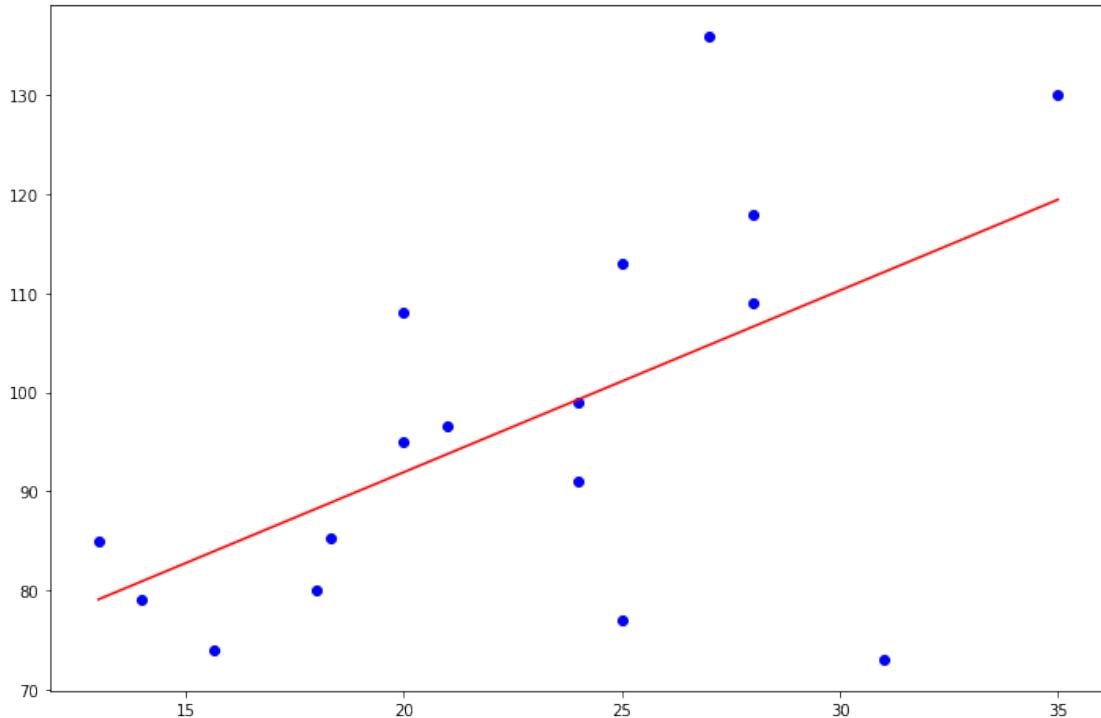
Warnings:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
"""

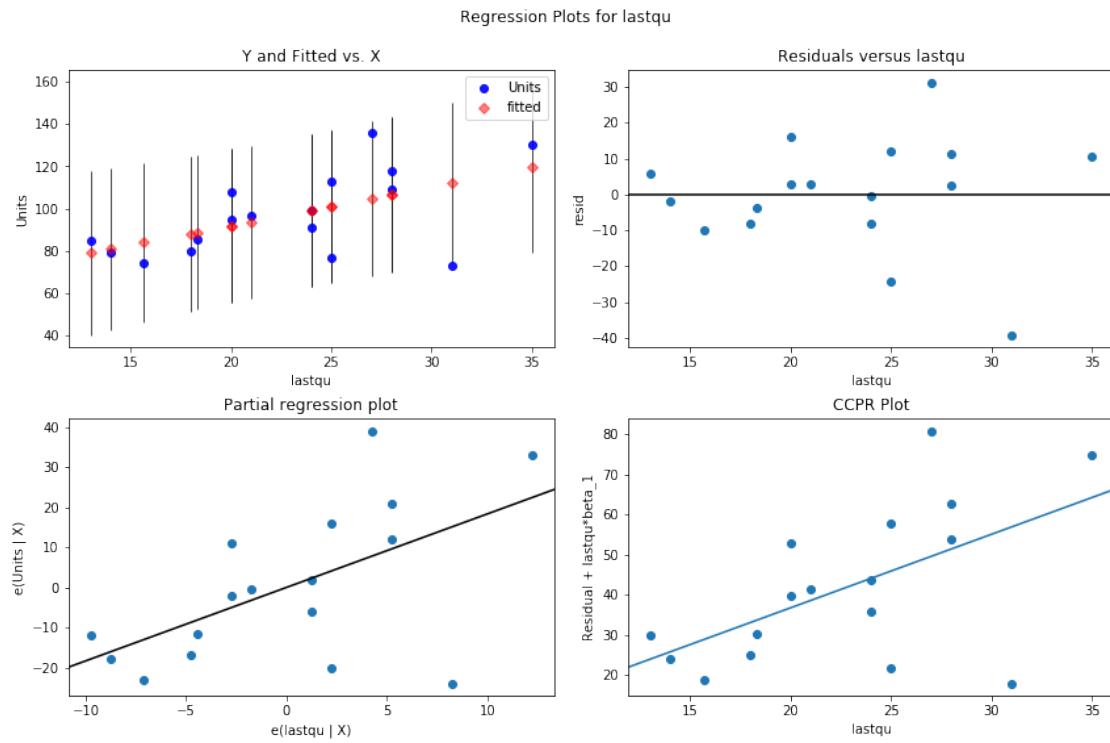
'Area Historical errors on Fcast: Monroe'

'Area mergedfcast: Monroe'

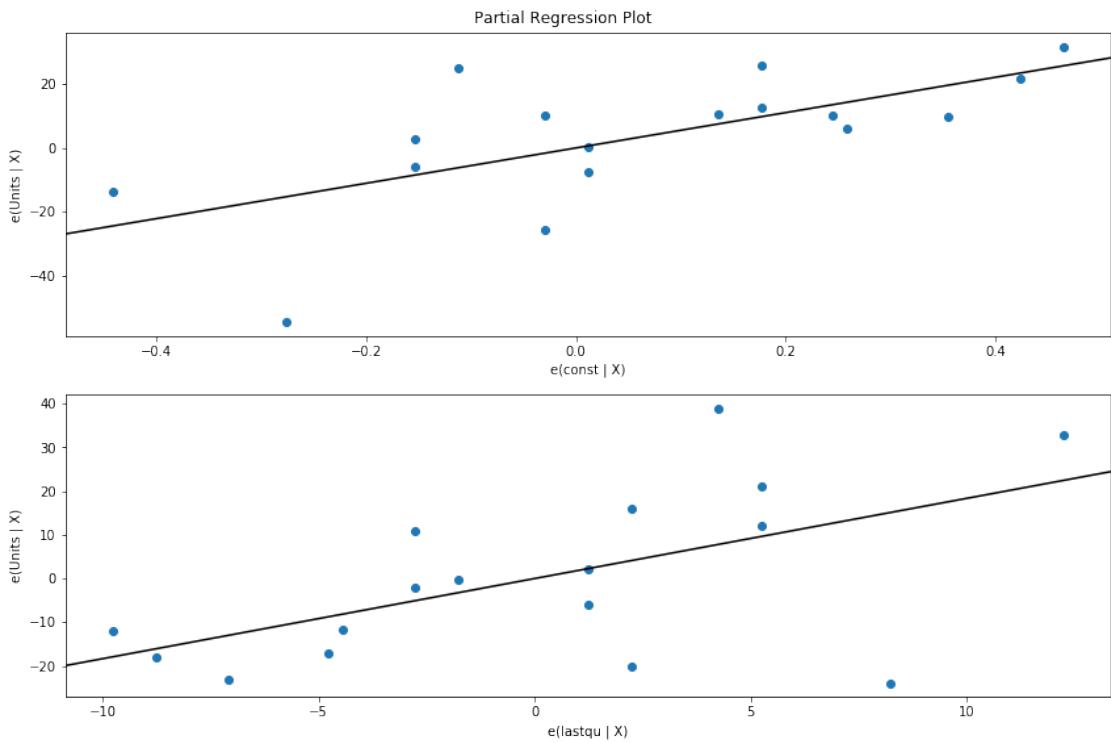
Monroe



Monroe



Monroe



Monroe

Area: Monroe Forecast for 2018 [ 105.] vs. Actual 2017 of 95.0



```
'Area fcast summary: Montgomery'
```

```
'Area regress: Montgomery'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                 Units        R-squared:     0.814
Model:                          OLS        Adj. R-squared:  0.801
Method:                         Least Squares    F-statistic:   65.44
Date: Mon, 29 Jan 2018          Prob (F-statistic): 7.51e-07
Time: 16:57:23                  Log-Likelihood: -127.33
No. Observations:               17         AIC:            258.7
Df Residuals:                  15         BIC:            260.3
Df Model:                      1
Covariance Type:               nonrobust
=====
              coef      std err       t      P>|t|      [0.025      0.975]
-----
const      688.4100    460.458     1.495     0.156    -293.034    1669.854
lastqu     3.7347     0.462      8.090     0.000      2.751      4.719
=====
Omnibus:                   1.360    Durbin-Watson:  1.162
Prob(Omnibus):             0.507    Jarque-Bera (JB): 0.332
Skew:                     -0.309    Prob(JB):      0.847
Kurtosis:                  3.296    Cond. No. 4.11e+03
=====
```

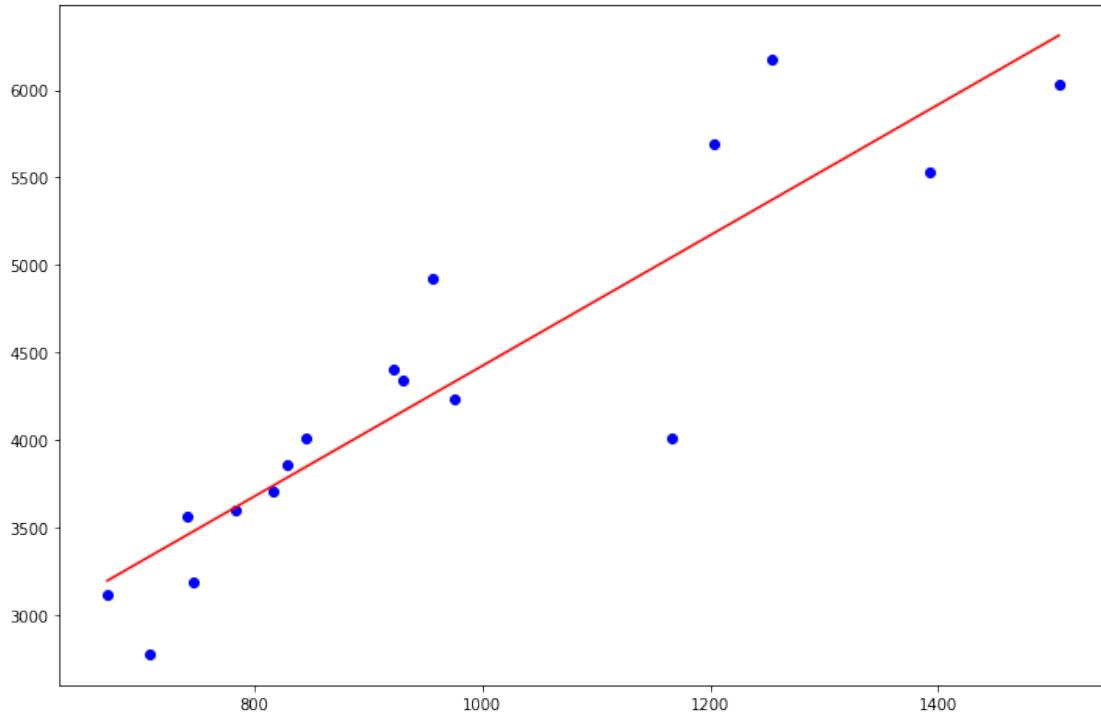
Warnings:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
  - [2] The condition number is large, 4.11e+03. This might indicate that there are strong multicollinearity or other numerical problems.
- """

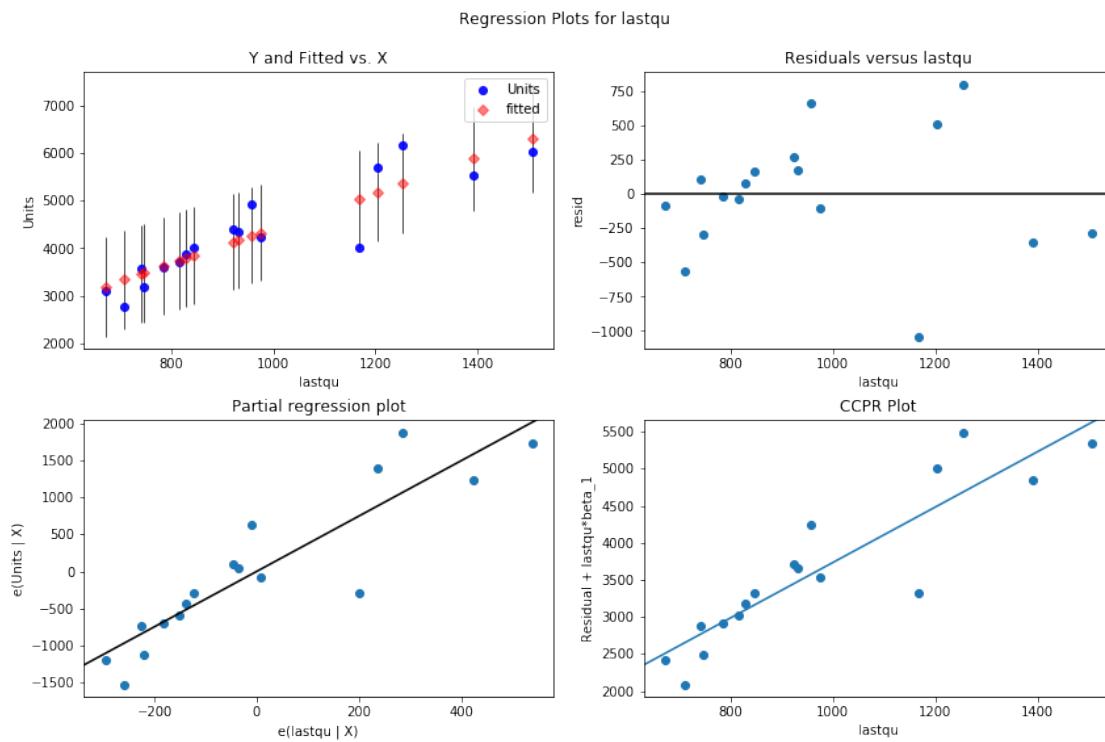
```
'Area Historical errors on Fcast: Montgomery'
```

```
'Area mergedfcast: Montgomery'
```

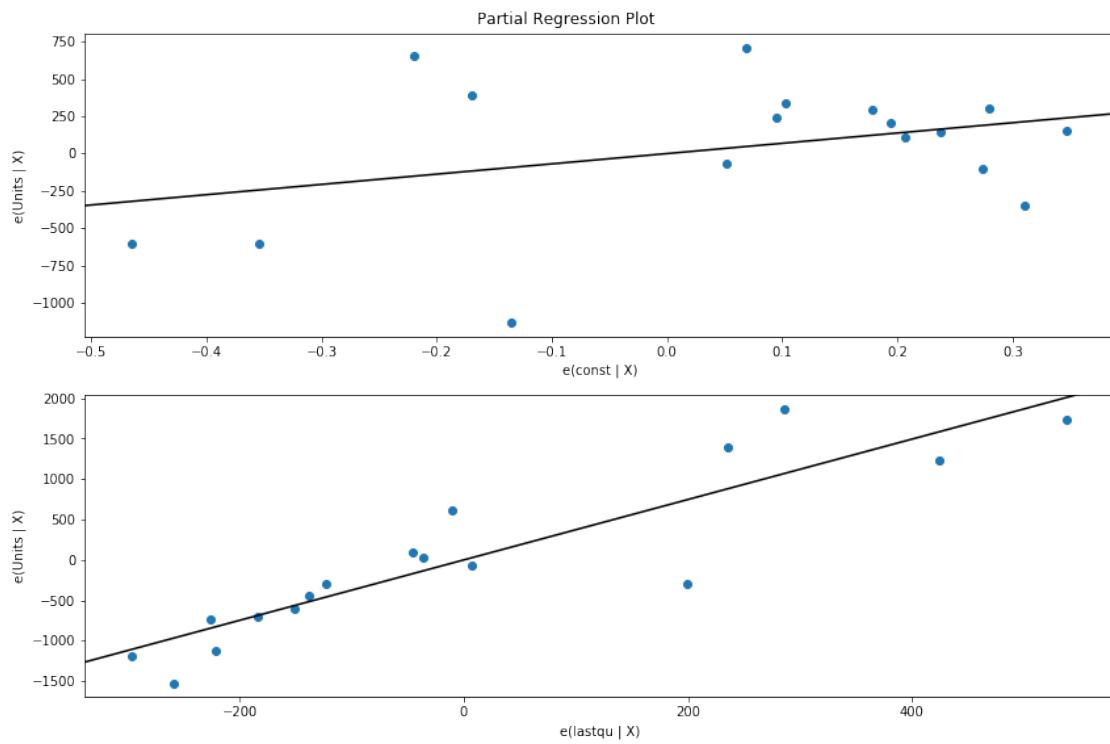
Montgomery



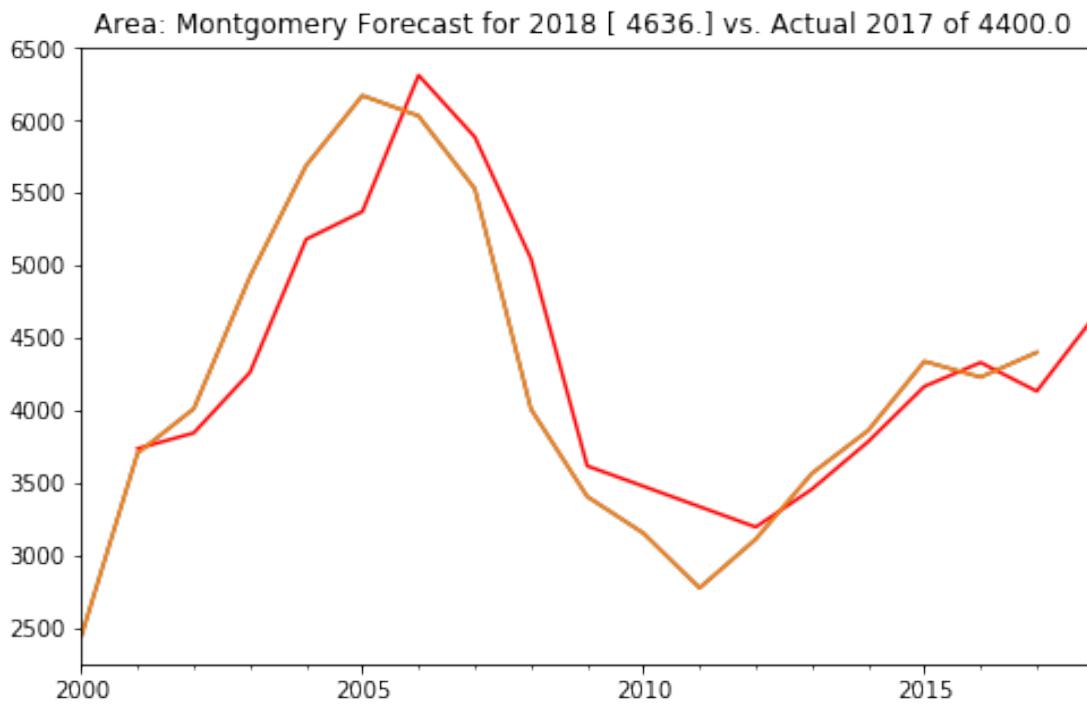
Montgomery



Montgomery



Montgomery



'Area fcast summary: Morgan'

'Area regress: Morgan'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
            OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.661
Model:                            OLS      Adj. R-squared:             0.624
Method:                           Least Squares      F-statistic:                  17.58
Date:                          Mon, 29 Jan 2018      Prob (F-statistic):        0.00233
Time:                            16:57:27      Log-Likelihood:           -67.837
No. Observations:                   11      AIC:                         139.7
Df Residuals:                      9      BIC:                         140.5
Df Model:                           1
Covariance Type:                nonrobust
=====
              coef    std err          t      P>|t|      [0.025      0.975]
-----
const      428.0141   209.211      2.046      0.071     -45.253     901.282
lastqu     2.9823     0.711      4.192      0.002       1.373      4.592
```

```
=====
Omnibus:                      0.422   Durbin-Watson:          1.284
Prob(Omnibus):                 0.810   Jarque-Bera (JB):      0.305
Skew:                           0.330   Prob(JB):                  0.858
Kurtosis:                      2.521   Cond. No.           1.60e+03
=====
```

Warnings:

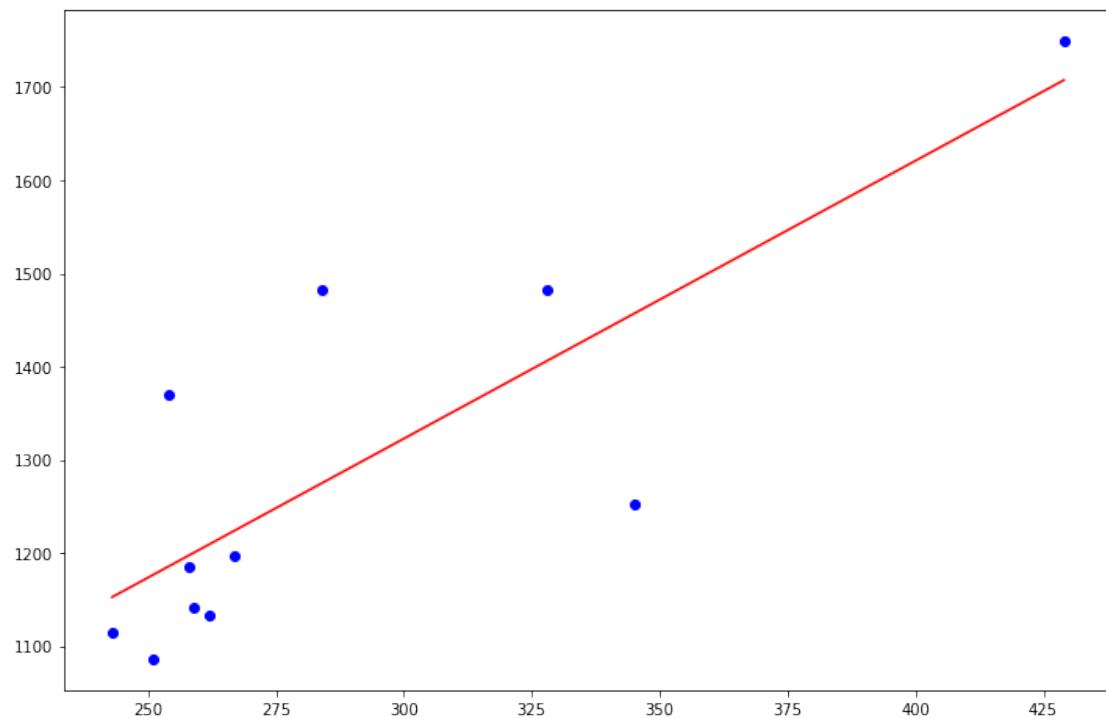
- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 1.6e+03. This might indicate that there are strong multicollinearity or other numerical problems.

'''

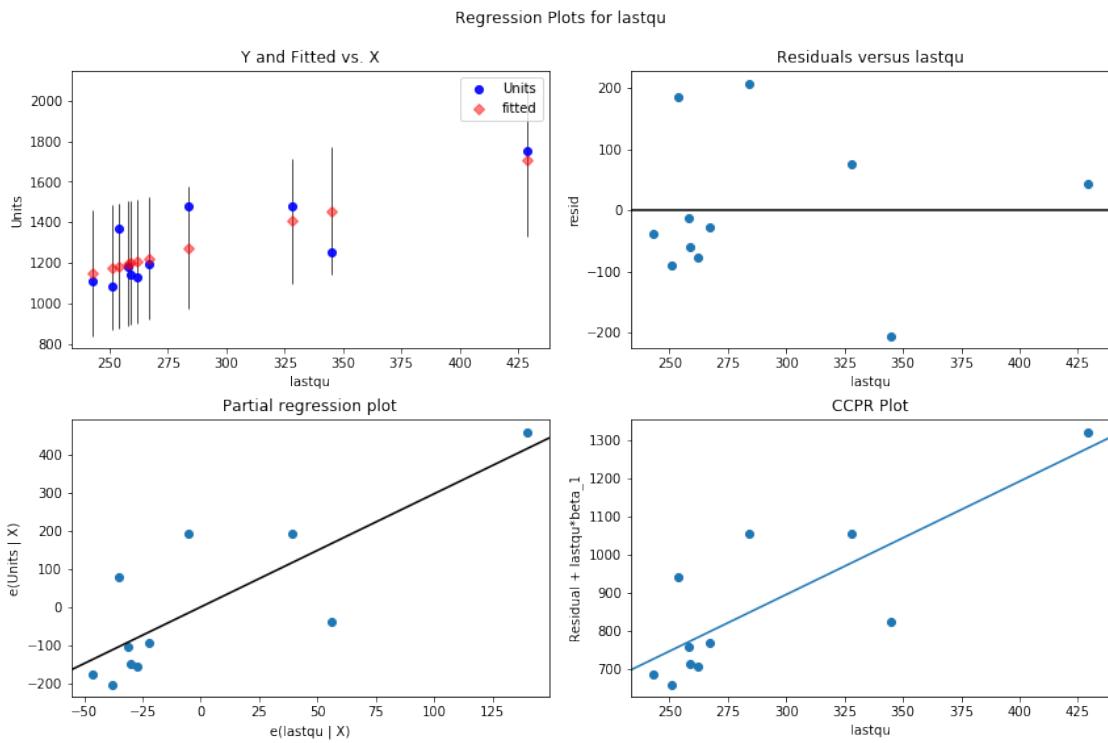
'Area Historical errors on Fcast: Morgan'

'Area mergedfcast: Morgan'

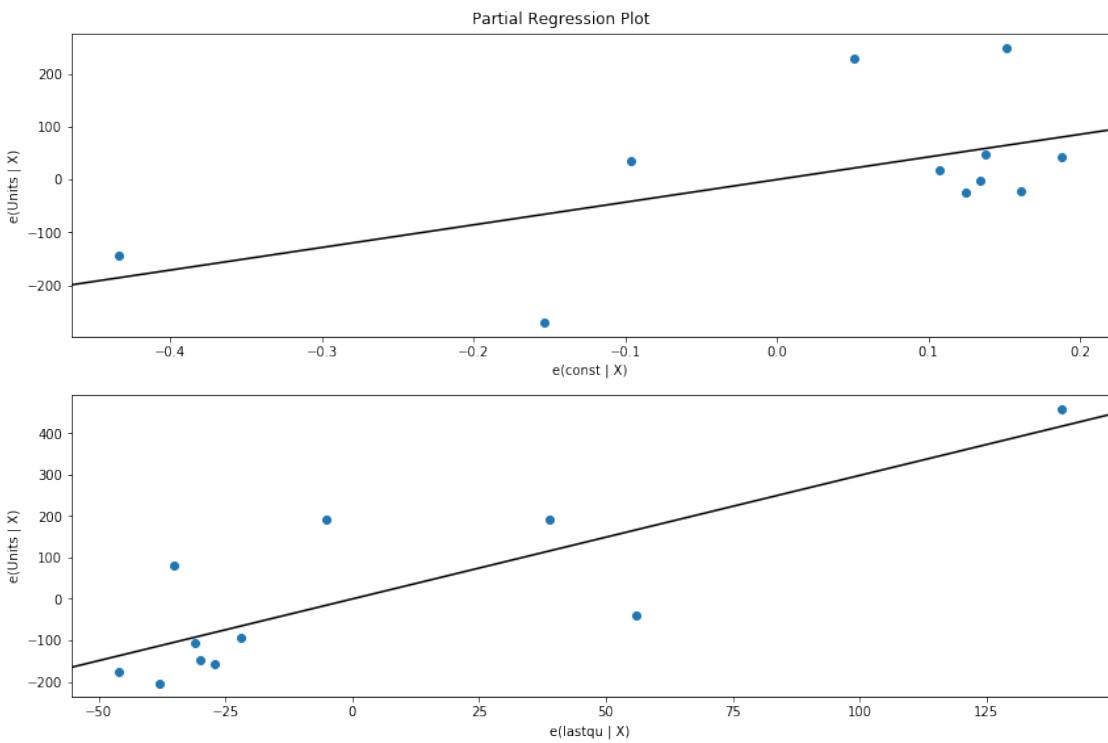
Morgan



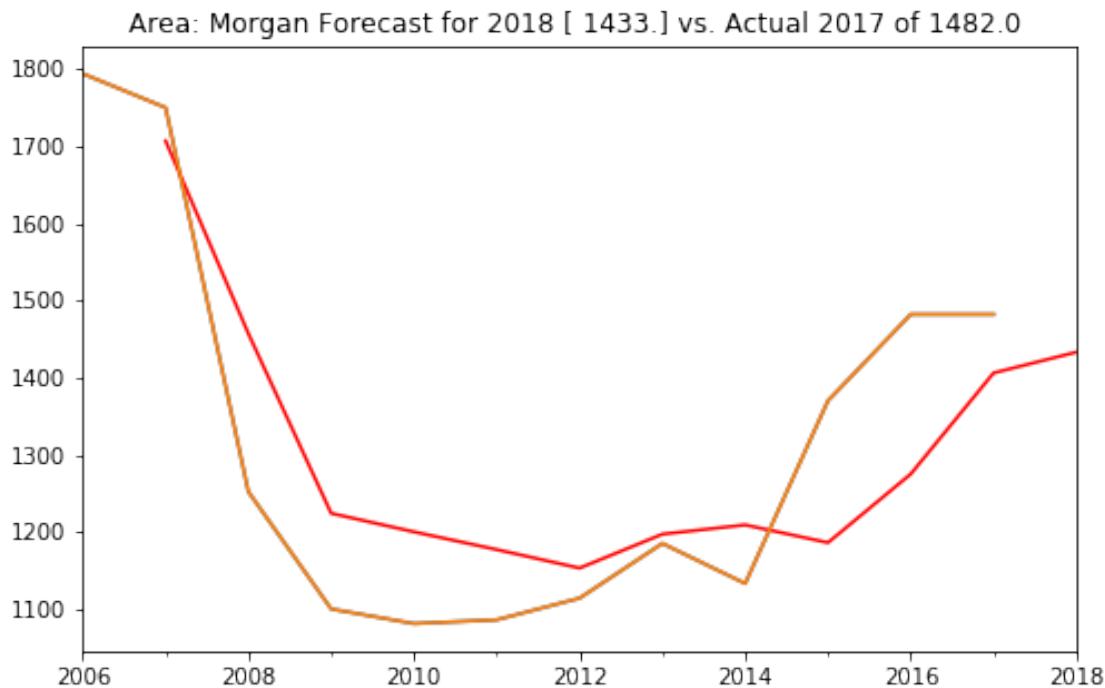
Morgan



Morgan



Morgan



'Area fcast summary: Shoals\_Area'

'Area regress: Shoals\_Area'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                  Units      R-squared:                 0.828
Model:                          OLS      Adj. R-squared:            0.817
Method:                         Least Squares      F-statistic:             72.38
Date: Mon, 29 Jan 2018      Prob (F-statistic):        4.00e-07
Time: 16:57:31                  Log-Likelihood:          -102.43
No. Observations:                   17      AIC:                      208.9
Df Residuals:                      15      BIC:                      210.5
Df Model:                           1
Covariance Type:            nonrobust
```

	coef	std err	t	P> t	[0.025	0.975]
const	383.2089	124.480	3.078	0.008	117.886	648.532
lastqu	3.3117	0.389	8.508	0.000	2.482	4.141
<hr/>						
Omnibus:		4.415	Durbin-Watson:		1.774	
Prob(Omnibus):		0.110	Jarque-Bera (JB):		2.829	
Skew:		-0.999	Prob(JB):		0.243	
Kurtosis:		3.074	Cond. No.		1.54e+03	
<hr/>						

Warnings:

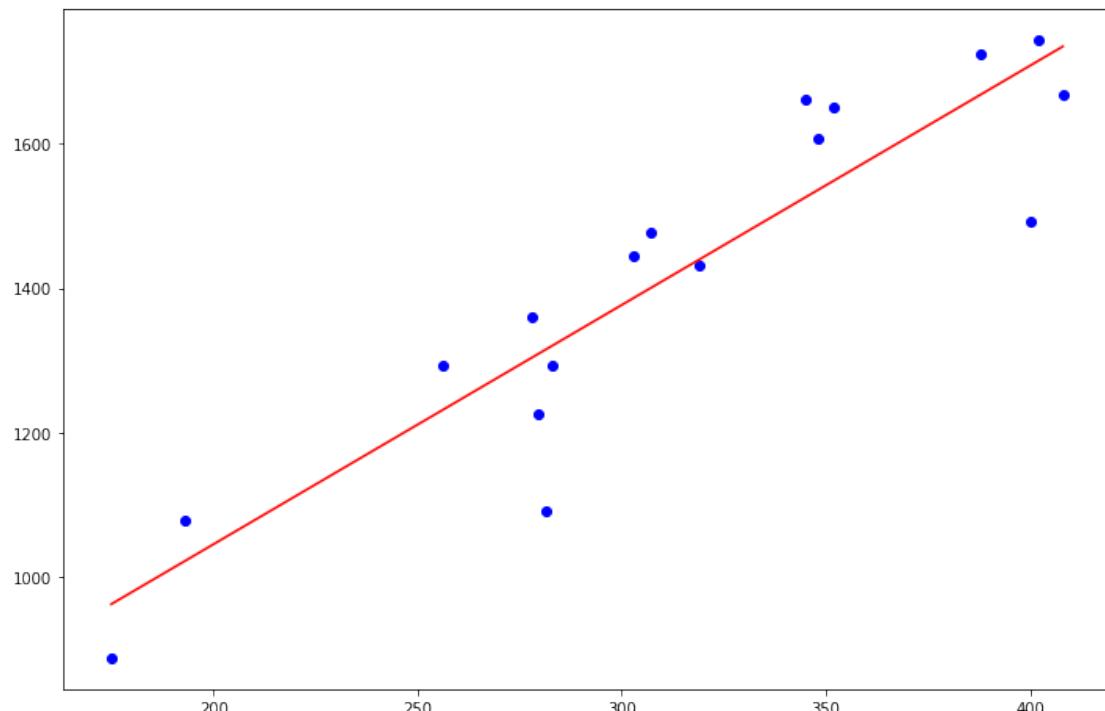
- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 1.54e+03. This might indicate that there are strong multicollinearity or other numerical problems.

"""

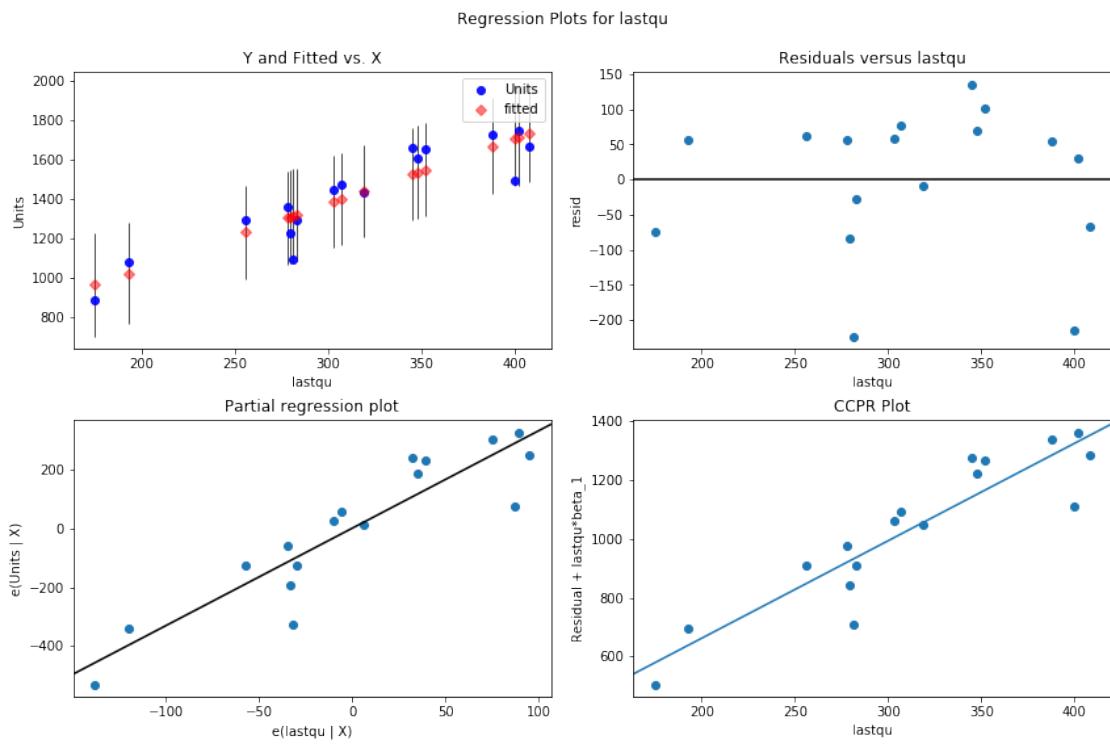
'Area Historical errors on Fcast: Shoals\_Area'

'Area mergedfcast: Shoals\_Area'

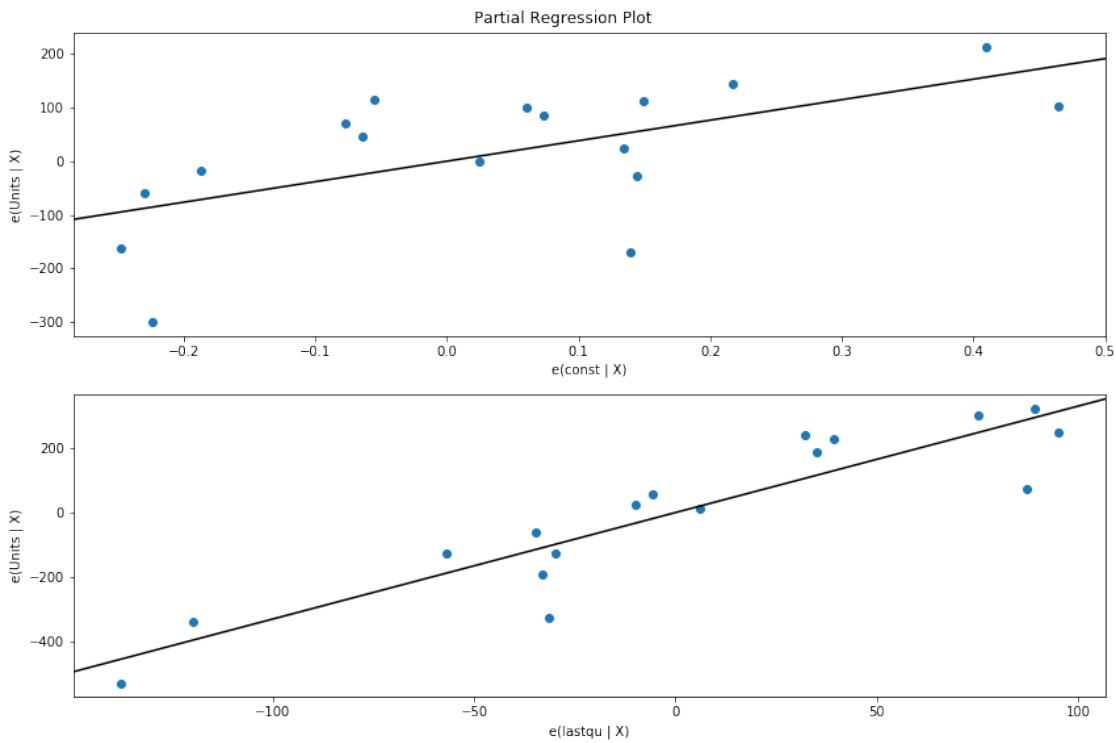
Shoals\_Area



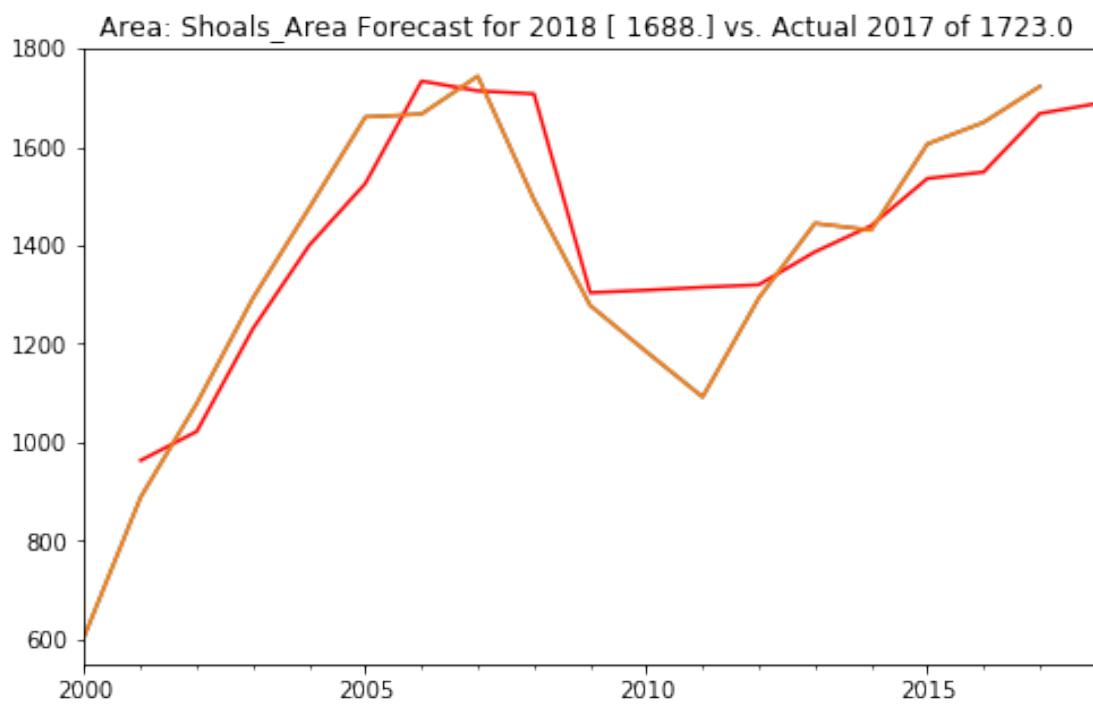
## Shoals\_Area



## Shoals\_Area



### Shoals\_Area



```
'Area fcast summary: Phenix_City'
```

```
'Area regress: Phenix_City'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.805
Model:                             OLS      Adj. R-squared:            0.792
Method:                            Least Squares      F-statistic:             62.08
Date:    Mon, 29 Jan 2018      Prob (F-statistic):        1.04e-06
Time:          16:57:34      Log-Likelihood:           -98.325
No. Observations:                  17      AIC:                     200.7
Df Residuals:                      15      BIC:                     202.3
Df Model:                           1
Covariance Type:                nonrobust
=====
              coef    std err          t      P>|t|      [0.025      0.975]
-----
const      261.5068     94.079      2.780      0.014     60.982     462.032
lastqu      3.3896     0.430      7.879      0.000      2.473      4.307
=====
Omnibus:                   1.710      Durbin-Watson:            1.238
Prob(Omnibus):               0.425      Jarque-Bera (JB):         0.953
Skew:                    -0.145      Prob(JB):                  0.621
Kurtosis:                   1.877      Cond. No.            1.01e+03
=====
```

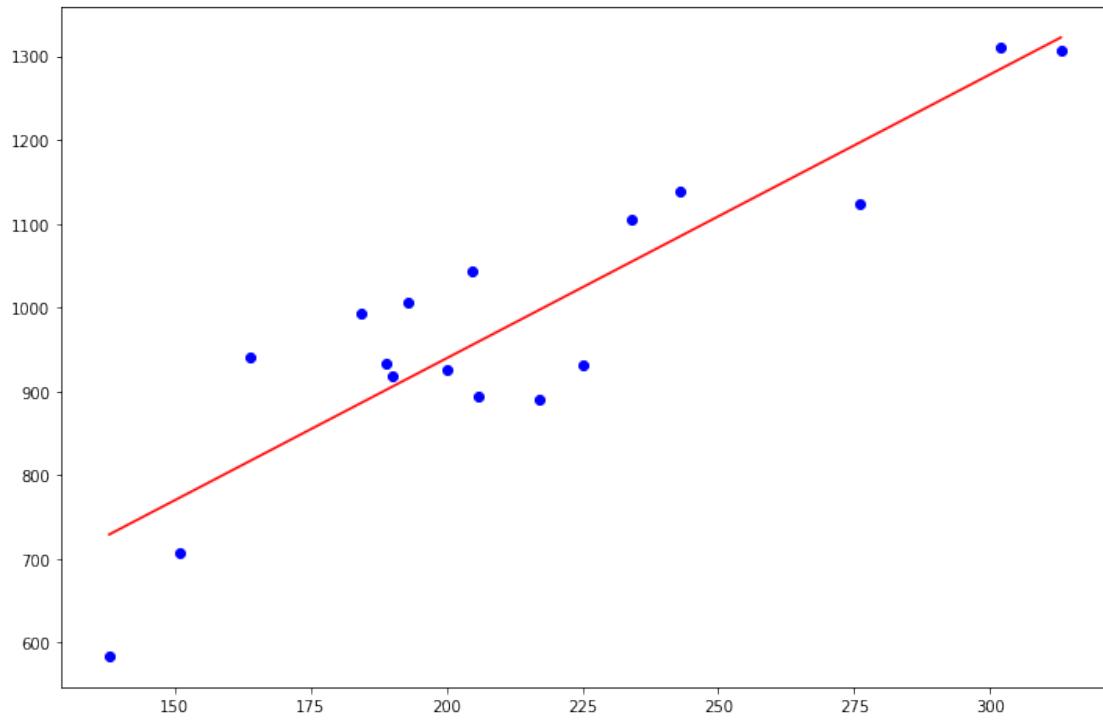
Warnings:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
  - [2] The condition number is large, 1.01e+03. This might indicate that there are strong multicollinearity or other numerical problems.
- """

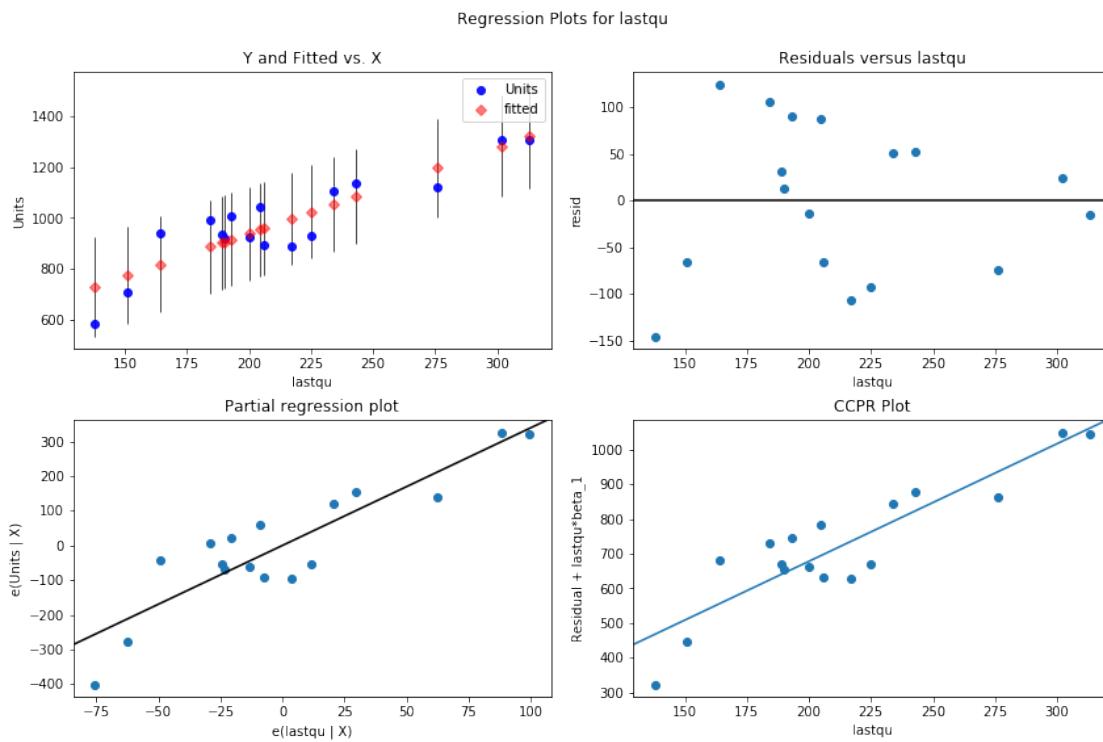
```
'Area Historical errors on Fcast: Phenix_City'
```

```
'Area mergedfcast: Phenix_City'
```

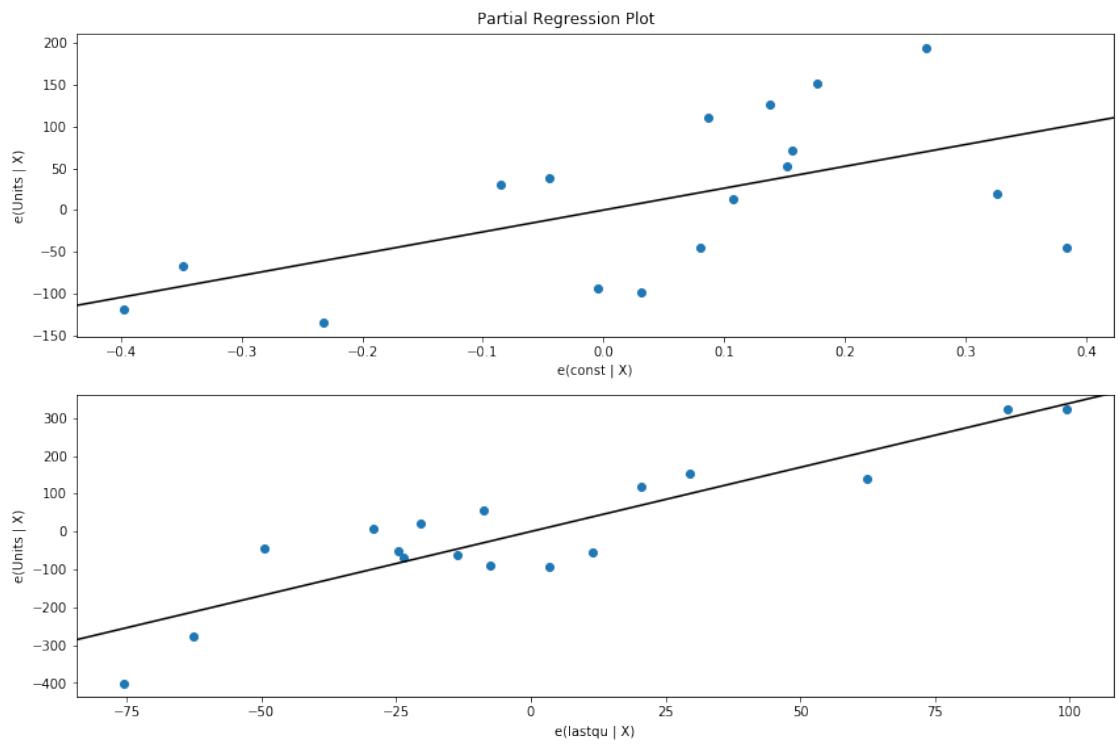
Phenix\_City



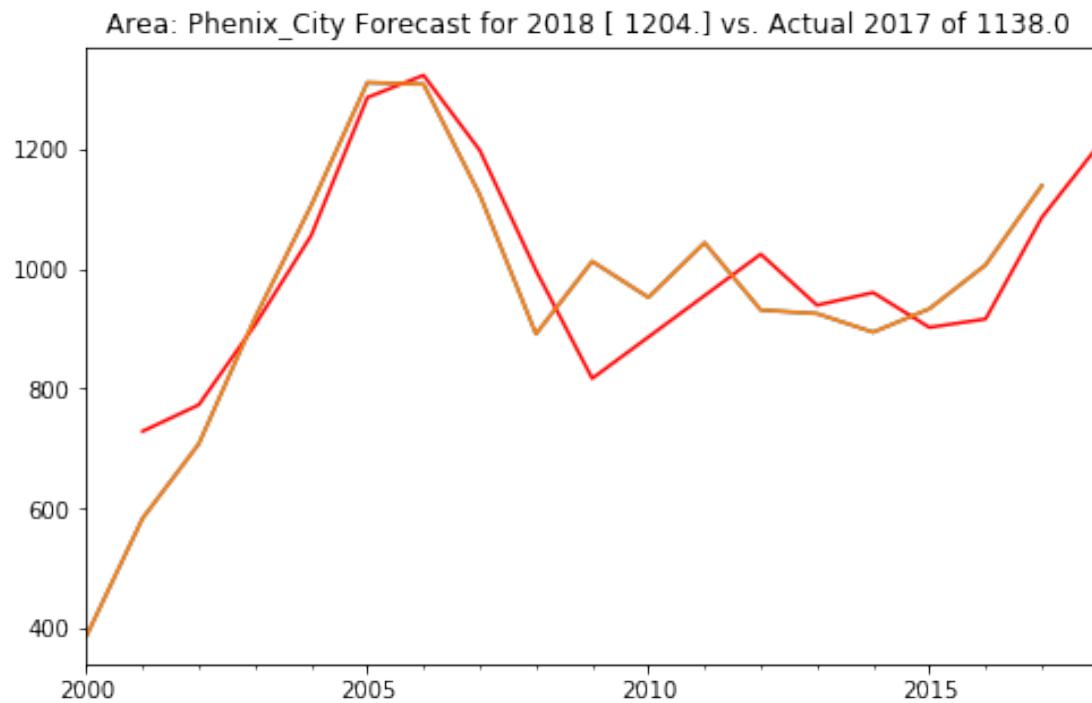
Phenix\_City



## Phenix\_City



## Phenix\_City



```
'Area fcast summary: Selma'
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis
    "anyway, n=%i" % int(n))
```

```
'Area regress: Selma'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.577
Model:                            OLS      Adj. R-squared:             0.547
Method:                           Least Squares      F-statistic:                  19.13
Date: Mon, 29 Jan 2018      Prob (F-statistic):        0.000636
Time: 16:57:37      Log-Likelihood:           -67.855
No. Observations:                   16      AIC:                         139.7
Df Residuals:                      14      BIC:                         141.3
Df Model:                           1
Covariance Type:            nonrobust
=====
```

	coef	std err	t	P> t	[0.025	0.975]
<hr/>						
const	67.9234	17.301	3.926	0.002	30.816	105.031
lastqu	2.4258	0.555	4.374	0.001	1.236	3.615
<hr/>						
Omnibus:		0.383	Durbin-Watson:		1.190	
Prob(Omnibus):		0.826	Jarque-Bera (JB):		0.082	
Skew:		0.163	Prob(JB):		0.960	
Kurtosis:		2.870	Cond. No.		120.	
<hr/>						

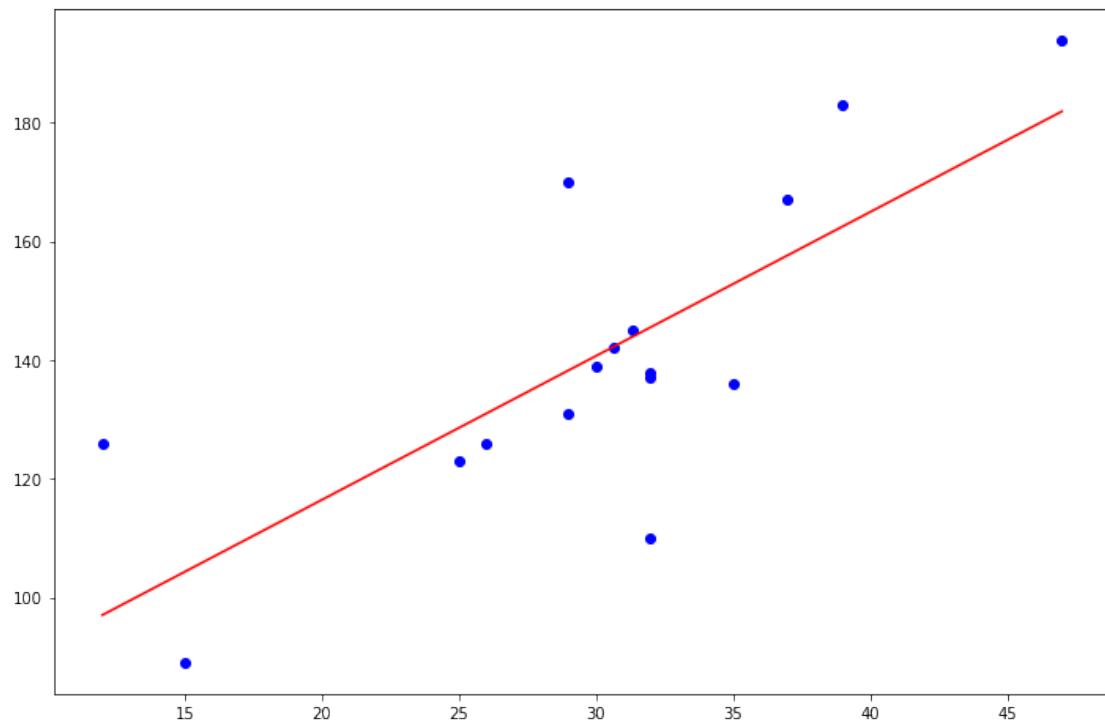
Warnings:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
'''

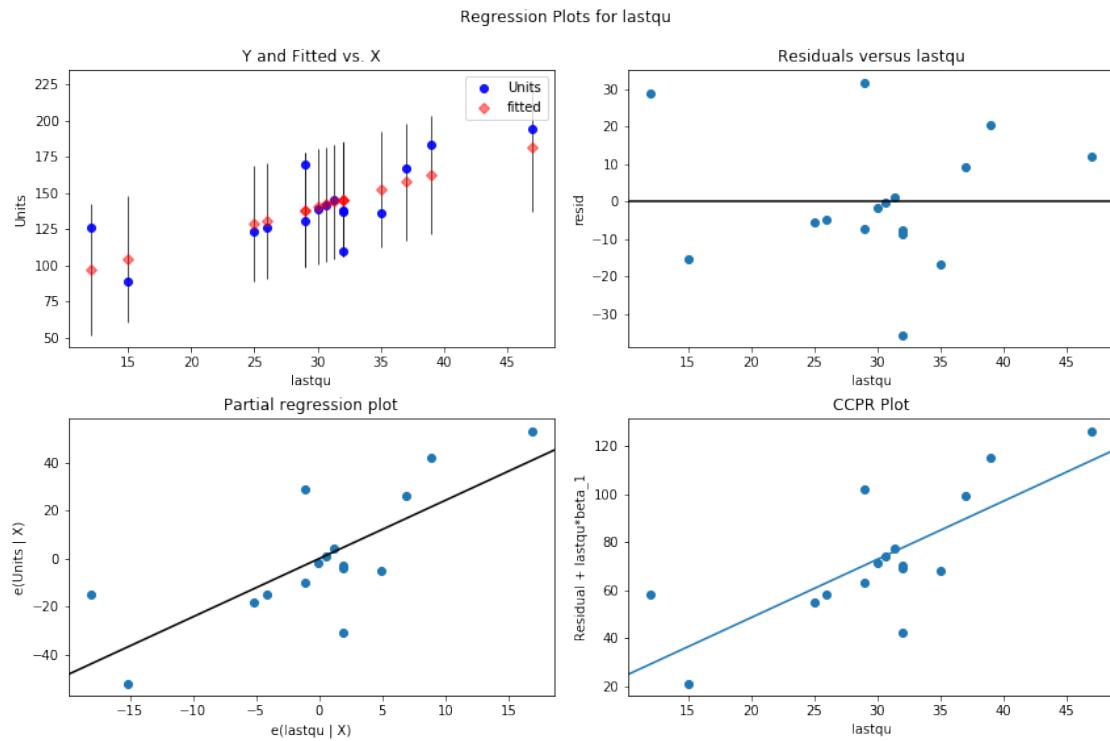
'Area Historical errors on Fcast: Selma'

'Area mergedfcast: Selma'

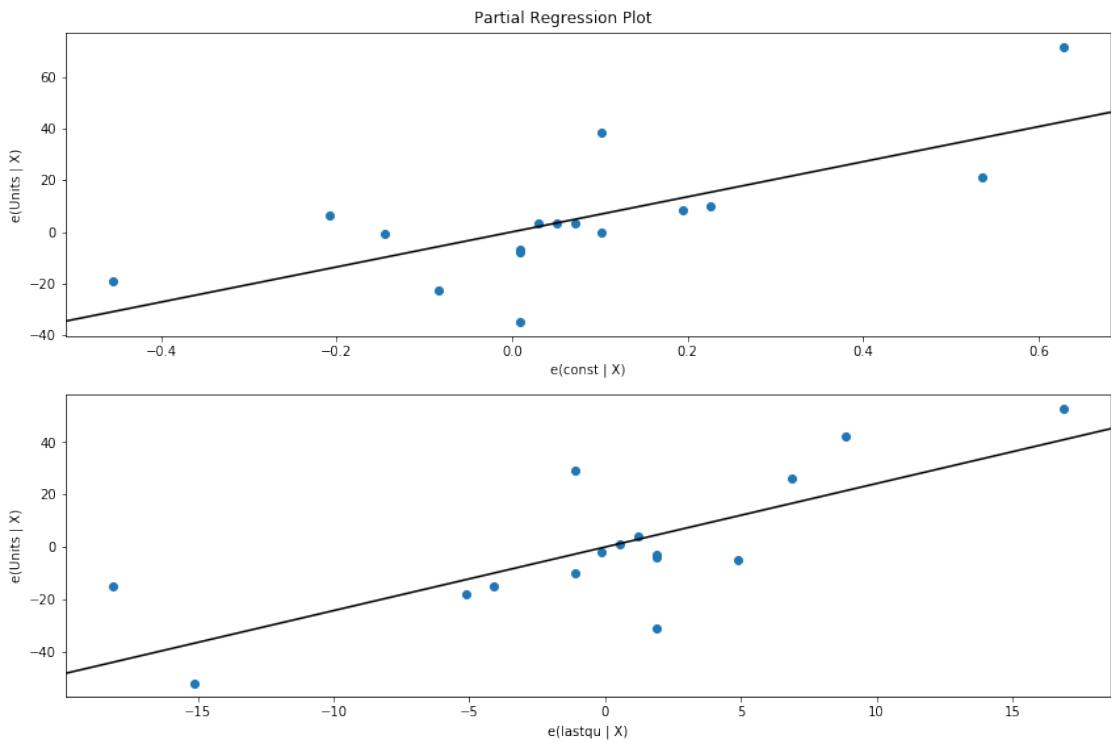
Selma



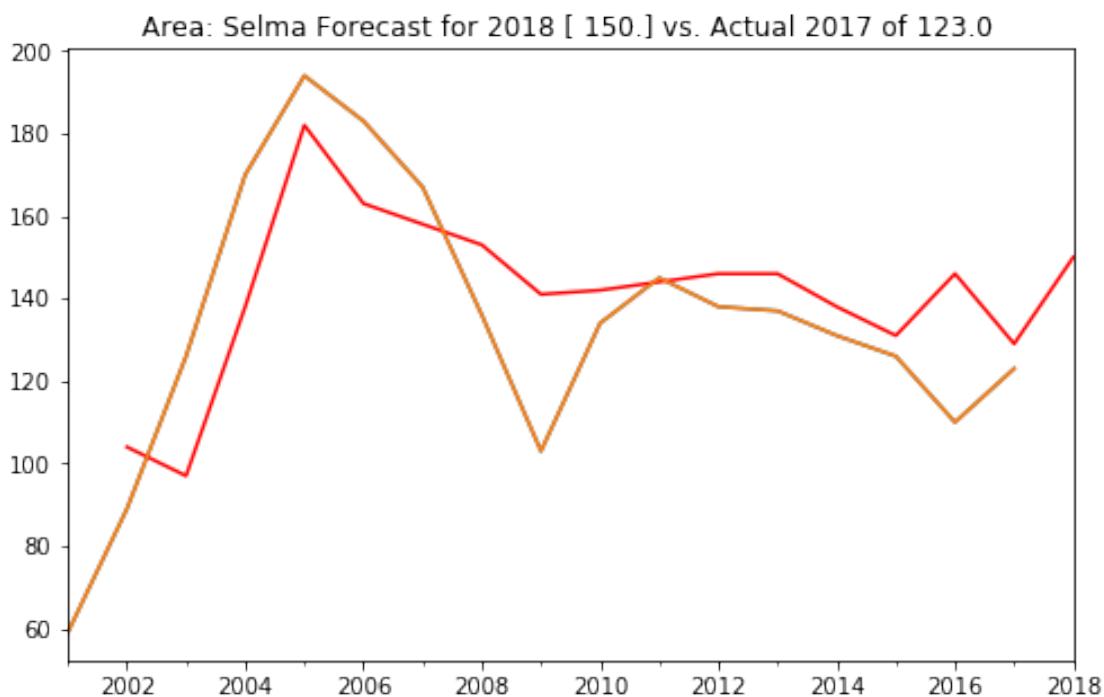
Selma



Selma



Selma



```
'Area fcast summary: Talladega'
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis  
"anyway, n=%i" % int(n))
```

```
'Area regress: Talladega'
```

```
<class 'statsmodels.iolib.summary.Summary'>
```

```
"""
```

### OLS Regression Results

Dep. Variable:	Units	R-squared:	0.955
Model:	OLS	Adj. R-squared:	0.950
Method:	Least Squares	F-statistic:	170.7
Date:	Mon, 29 Jan 2018	Prob (F-statistic):	1.12e-06
Time:	16:57:40	Log-Likelihood:	-48.371
No. Observations:	10	AIC:	100.7
Df Residuals:	8	BIC:	101.3
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	11.3614	21.418	0.530	0.610	-38.029	60.752
lastqu	4.2861	0.328	13.065	0.000	3.530	5.043

Omnibus:	4.472	Durbin-Watson:	2.153
Prob(Omnibus):	0.107	Jarque-Bera (JB):	1.877
Skew:	1.056	Prob(JB):	0.391
Kurtosis:	3.206	Cond. No.	130.

```
Warnings:
```

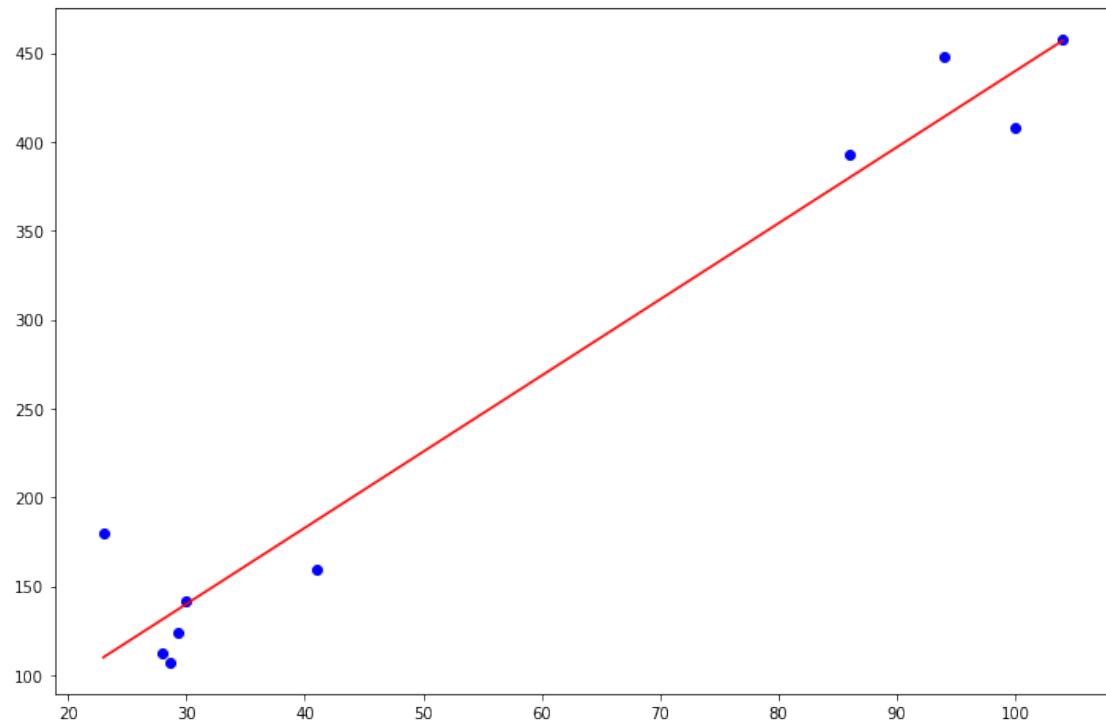
```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

```
"""
```

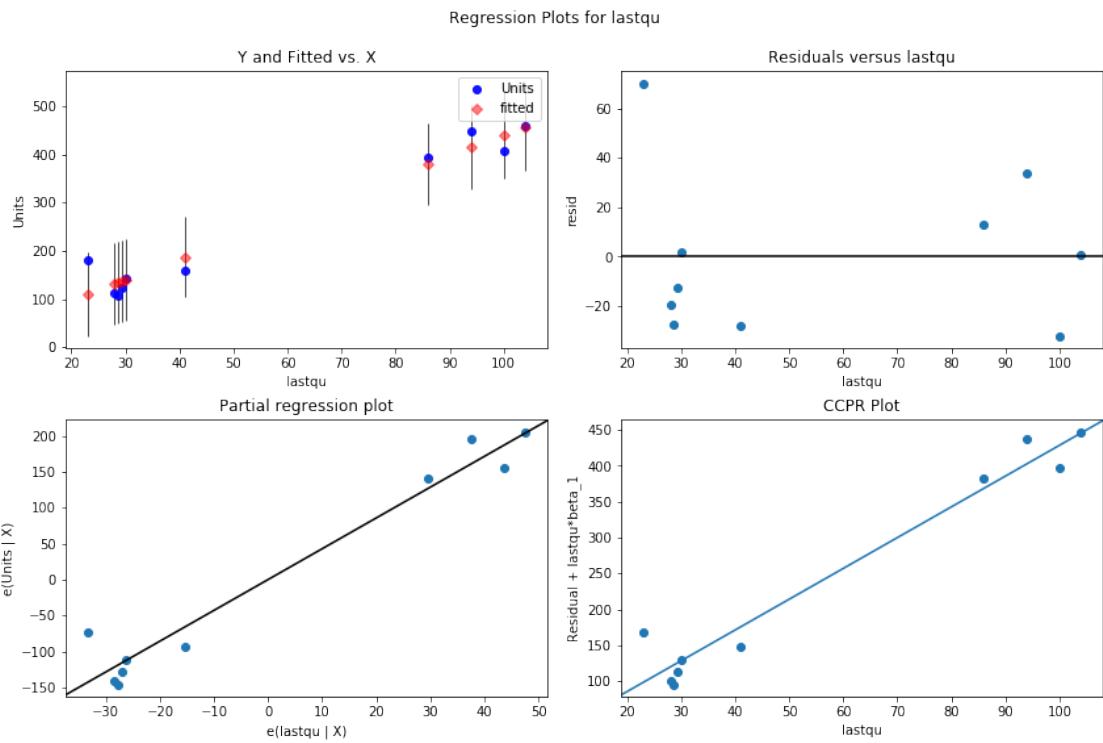
```
'Area Historical errors on Fcast: Talladega'
```

```
'Area mergedfcast: Talladega'
```

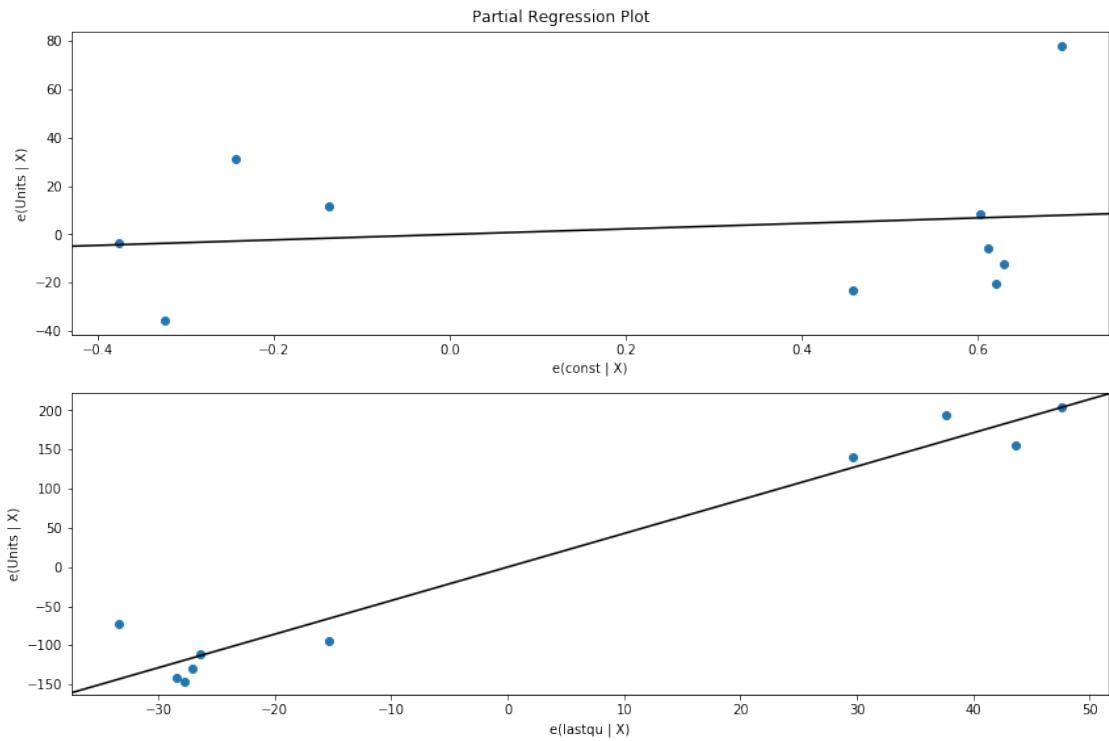
Talladega



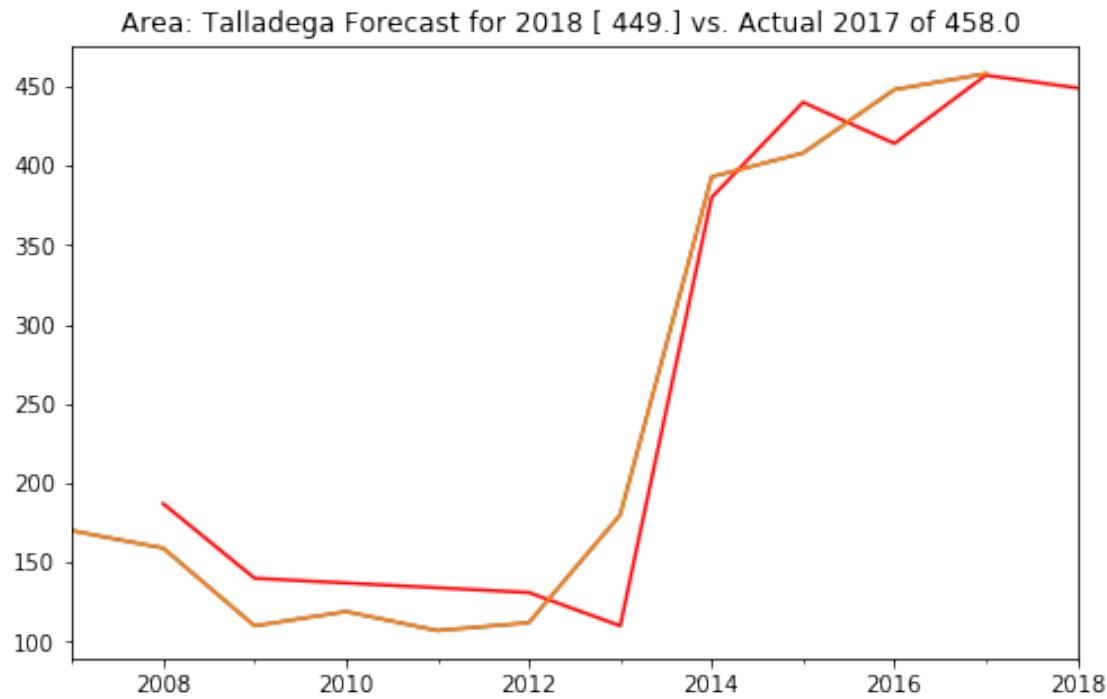
Talladega



Talladega



Talladega



'Area fcast summary: Tuscaloosa'

'Area regress: Tuscaloosa'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
=====
              OLS Regression Results
=====
Dep. Variable:                  Units      R-squared:         0.804
Model:                          OLS      Adj. R-squared:    0.791
Method:                         Least Squares      F-statistic:     61.46
Date: Mon, 29 Jan 2018            Prob (F-statistic): 1.10e-06
Time: 16:57:46                   Log-Likelihood:   -113.15
No. Observations:                 17          AIC:             230.3
Df Residuals:                      15          BIC:             232.0
Df Model:                           1
Covariance Type:                nonrobust
```

	coef	std err	t	P> t	[0.025	0.975]
const	324.4776	217.189	1.494	0.156	-138.449	787.404
lastqu	4.1737	0.532	7.840	0.000	3.039	5.308
<hr/>						
Omnibus:		2.270	Durbin-Watson:		2.536	
Prob(Omnibus):		0.321	Jarque-Bera (JB):		0.891	
Skew:		-0.532	Prob(JB):		0.641	
Kurtosis:		3.356	Cond. No.			1.82e+03
<hr/>						

Warnings:

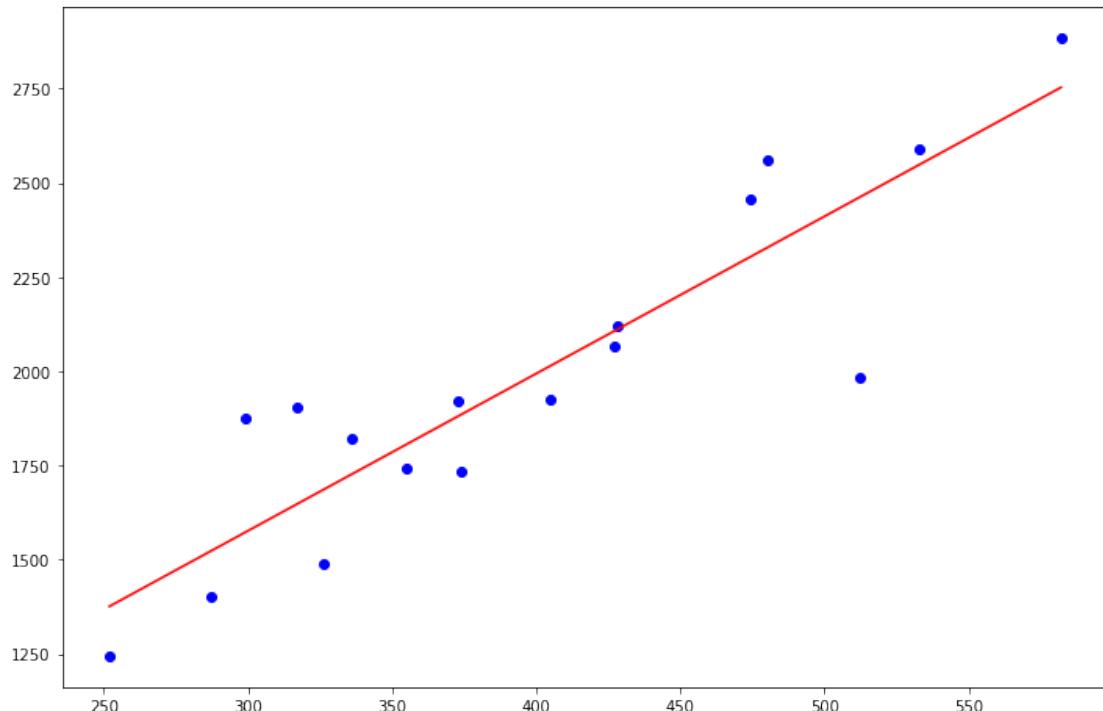
- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 1.82e+03. This might indicate that there are strong multicollinearity or other numerical problems.

"""

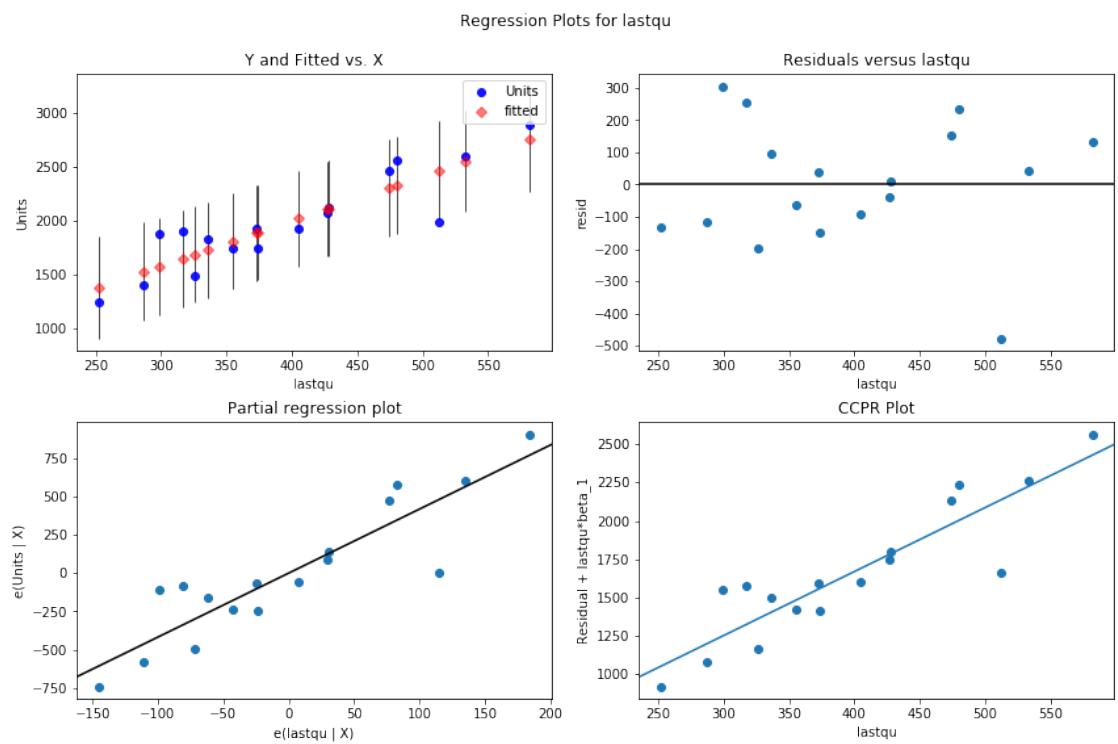
'Area Historical errors on Fcast: Tuscaloosa'

'Area mergedfcast: Tuscaloosa'

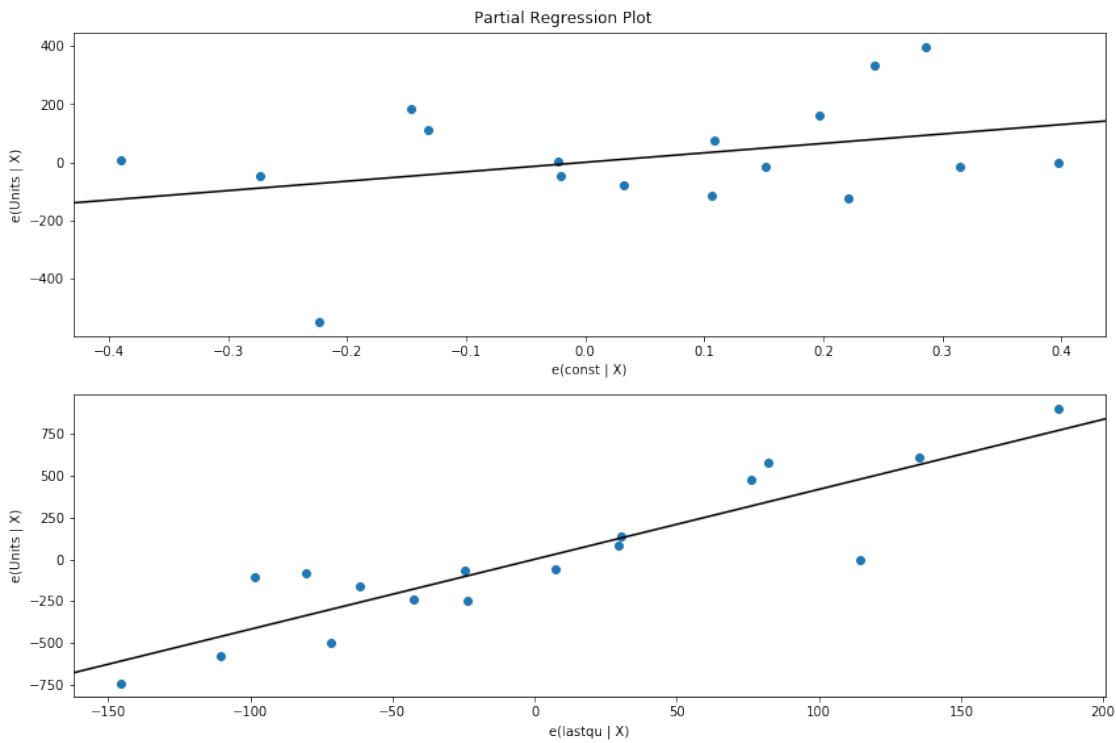
Tuscaloosa



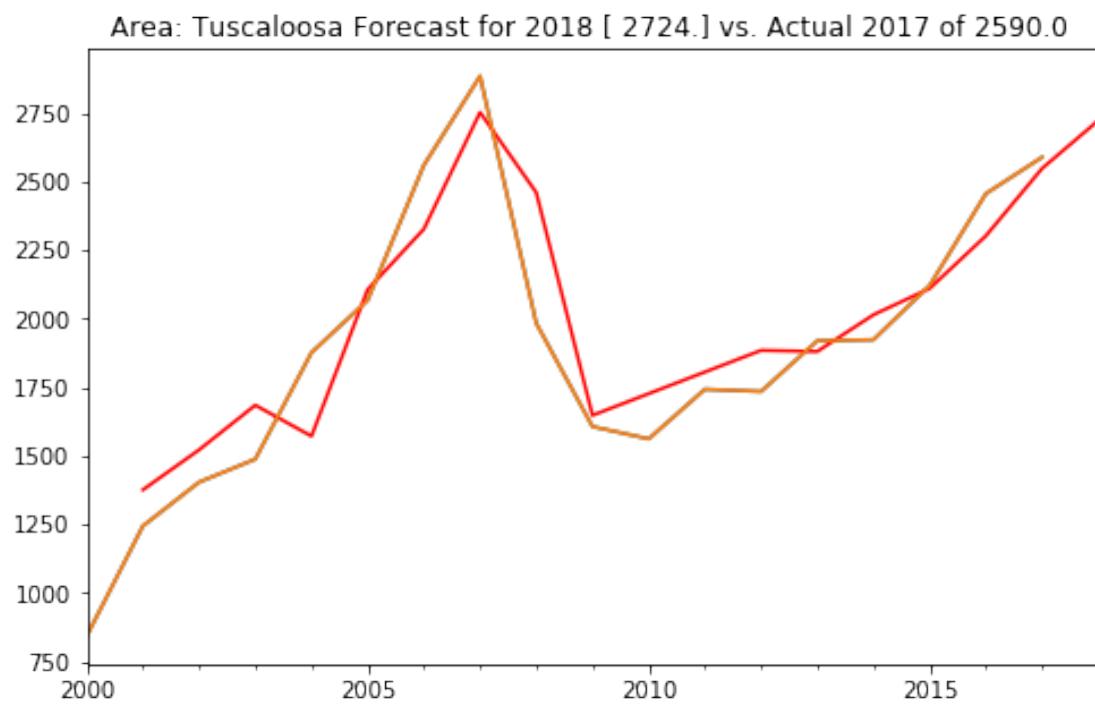
## Tuscaloosa



## Tuscaloosa



Tuscaloosa



```
'Area fcast summary: Walker'
```

```
'Area regress: Walker'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.918
Model:                            OLS      Adj. R-squared:            0.911
Method:                           Least Squares      F-statistic:             134.0
Date:    Mon, 29 Jan 2018      Prob (F-statistic):        7.21e-08
Time:          16:57:48      Log-Likelihood:           -76.759
No. Observations:                  14      AIC:                     157.5
Df Residuals:                      12      BIC:                     158.8
Df Model:                          1
Covariance Type:                nonrobust
=====
            coef      std err          t      P>|t|      [0.025      0.975]
-----
const     -11.1361      40.486     -0.275      0.788     -99.347     77.075
lastqu      4.8028      0.415     11.576      0.000       3.899      5.707
=====
Omnibus:                   1.021      Durbin-Watson:            2.585
Prob(Omnibus):               0.600      Jarque-Bera (JB):        0.885
Skew:                      -0.435      Prob(JB):                  0.643
Kurtosis:                   2.128      Cond. No.                 235.
=====
```

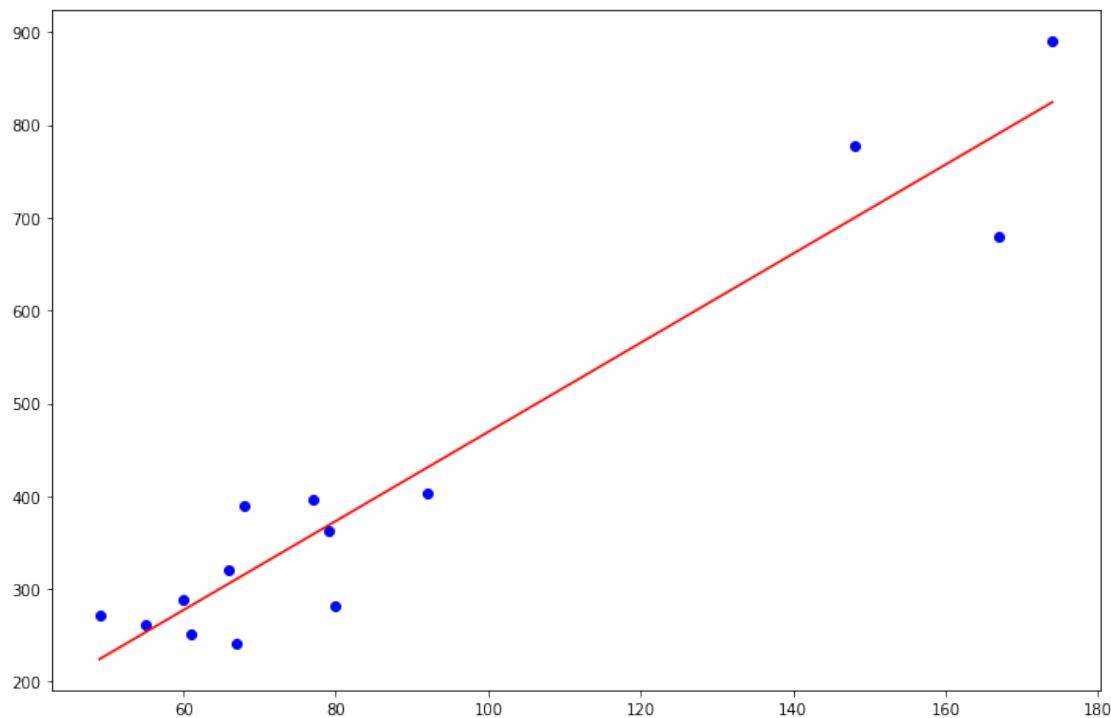
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
"""
```

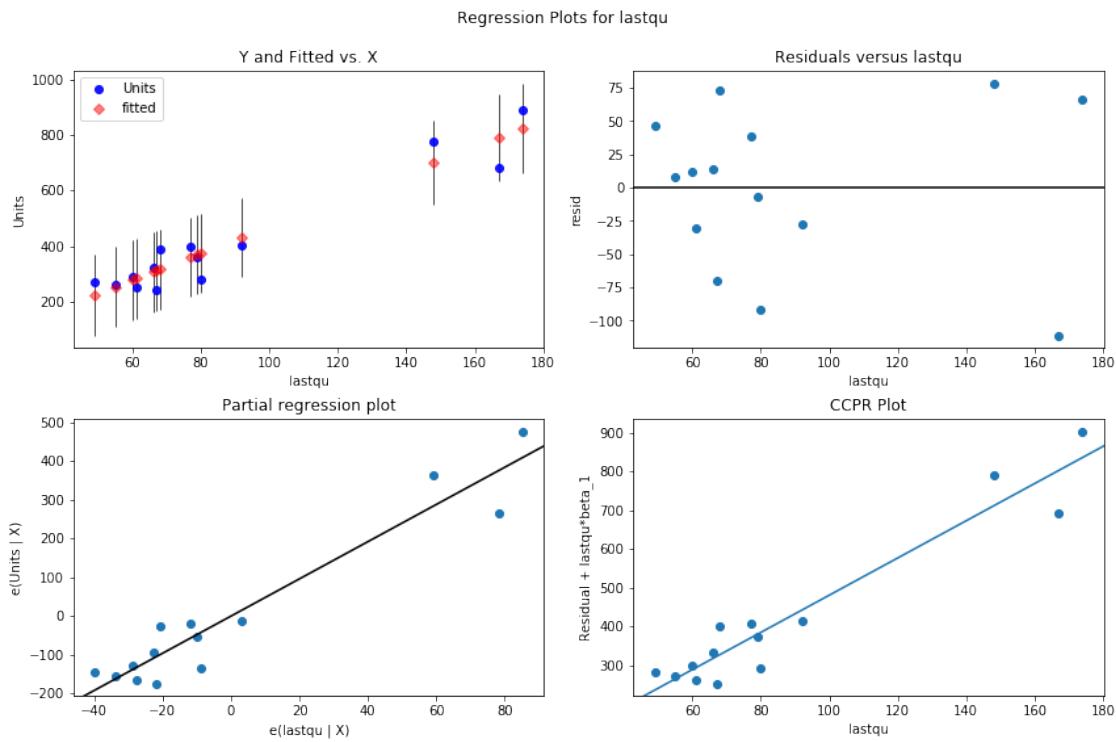
```
'Area Historical errors on Fcast: Walker'
```

```
'Area mergedfcast: Walker'
```

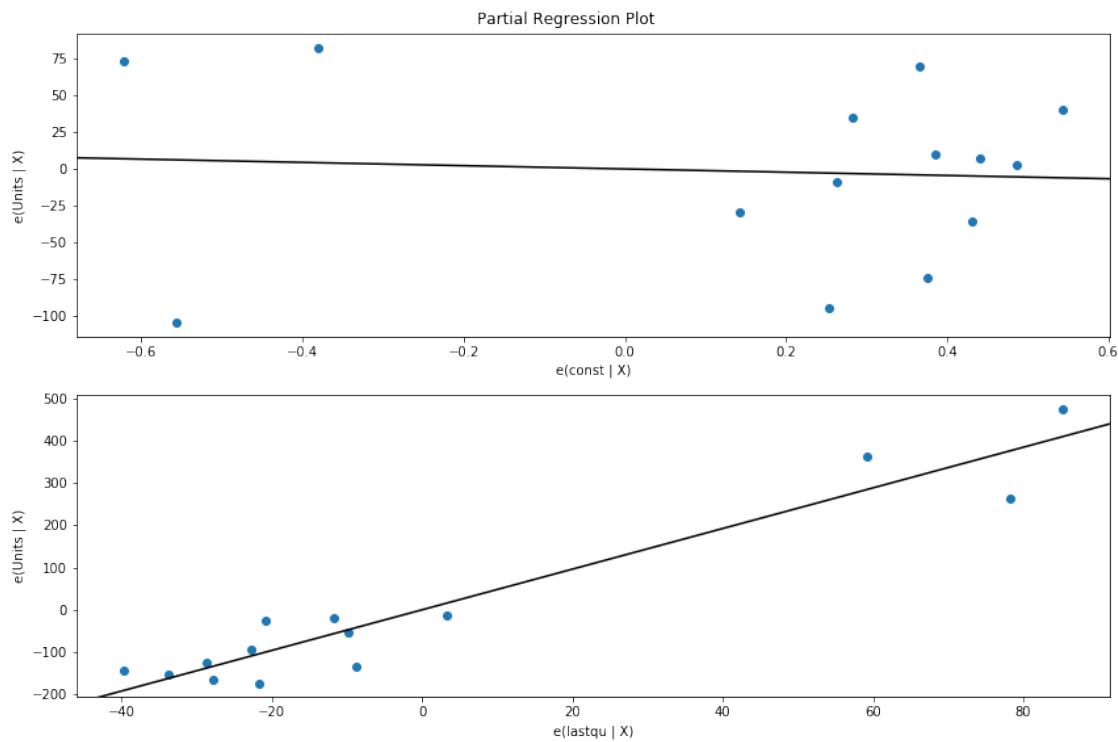
Walker



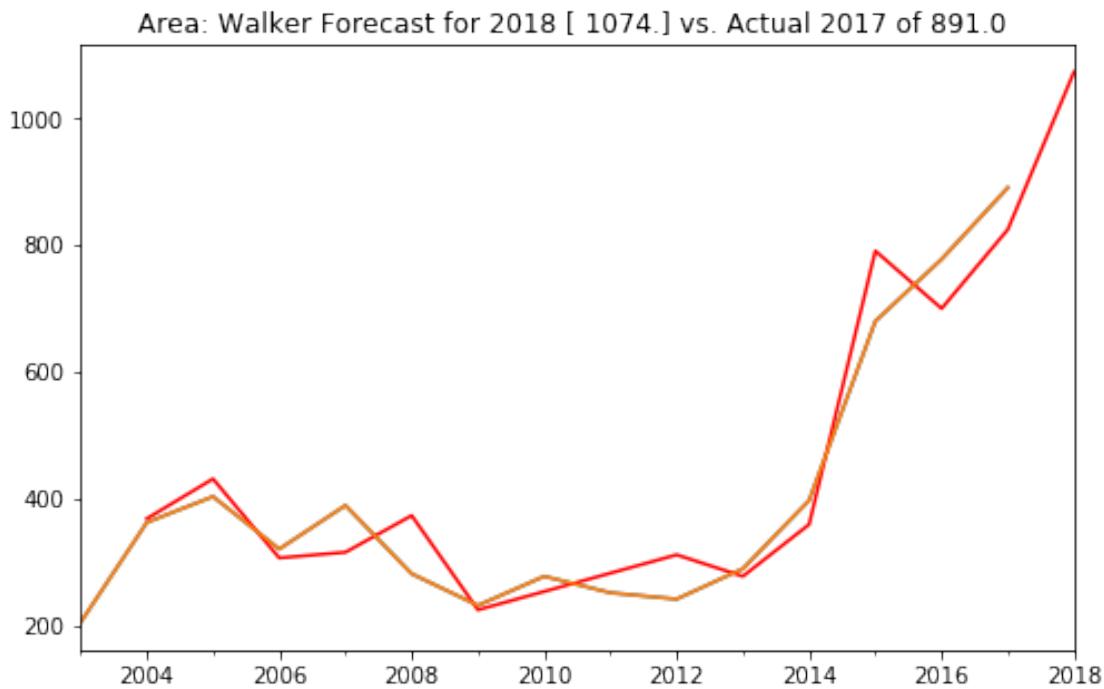
Walker



Walker



Walker



```
'Area fcast summary: Wiregrass'
```

```
'Area regress: Wiregrass'
```

```
<class 'statsmodels.iolib.summary.Summary'>
"""
=====
              OLS Regression Results
=====
Dep. Variable:                      Units
R-squared:                       0.730
Model:                            OLS
Adj. R-squared:                   0.712
Method:                           Least Squares
F-statistic:                     40.64
Date:    Mon, 29 Jan 2018
Time:    16:57:52
Prob (F-statistic):            1.25e-05
No. Observations:                  17
Log-Likelihood:                 -100.96
AIC:                             205.9
BIC:                             207.6
Df Residuals:                      15
Df Model:                           1
Covariance Type:                nonrobust
=====
      coef    std err          t      P>|t|      [0.025      0.975]
-----
const    218.6970   100.712      2.172      0.046      4.035    433.360
lastqu    3.5126     0.551      6.375      0.000      2.338     4.687
=====
```

Omnibus:	1.469	Durbin-Watson:	1.639
Prob(Omnibus):	0.480	Jarque-Bera (JB):	0.365
Skew:	-0.316	Prob(JB):	0.833
Kurtosis:	3.342	Cond. No.	777.

---

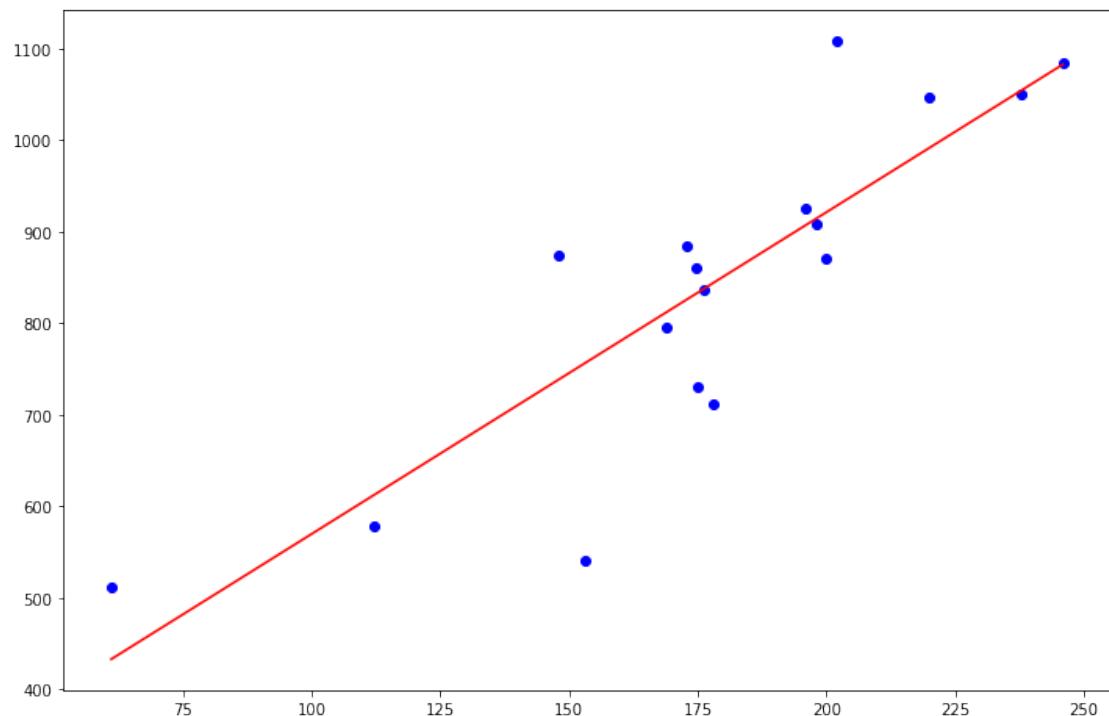
Warnings:

```
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
***
```

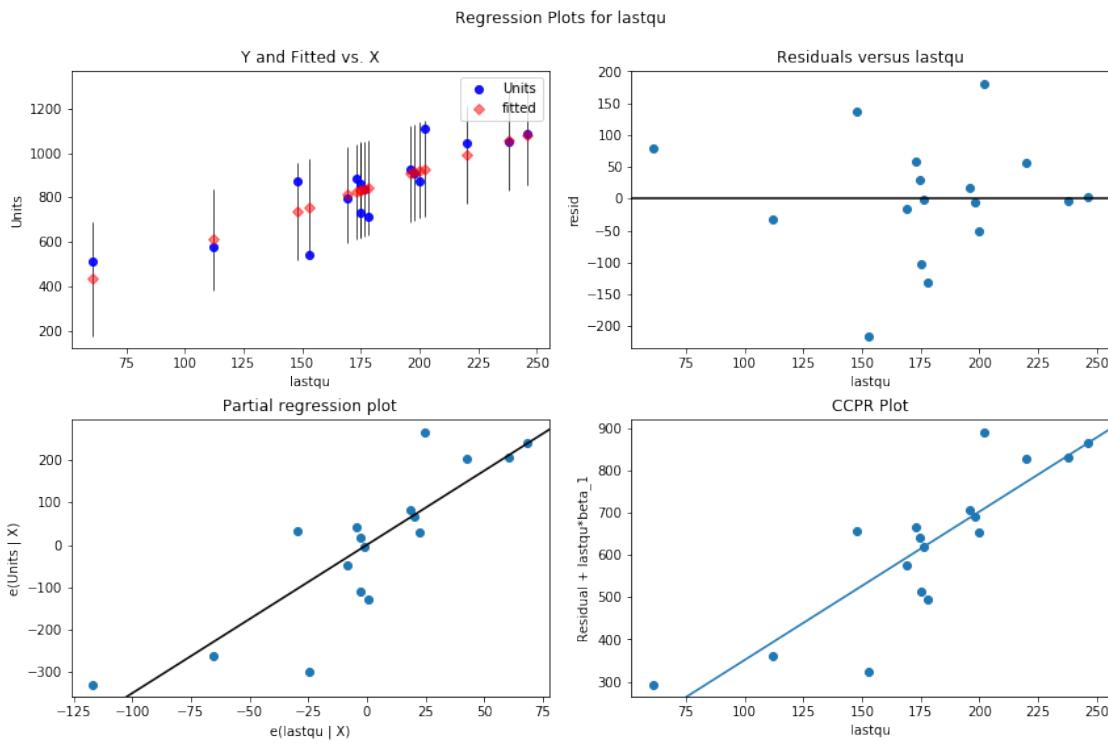
'Area Historical errors on Fcast: Wiregrass'

'Area mergedfcast: Wiregrass'

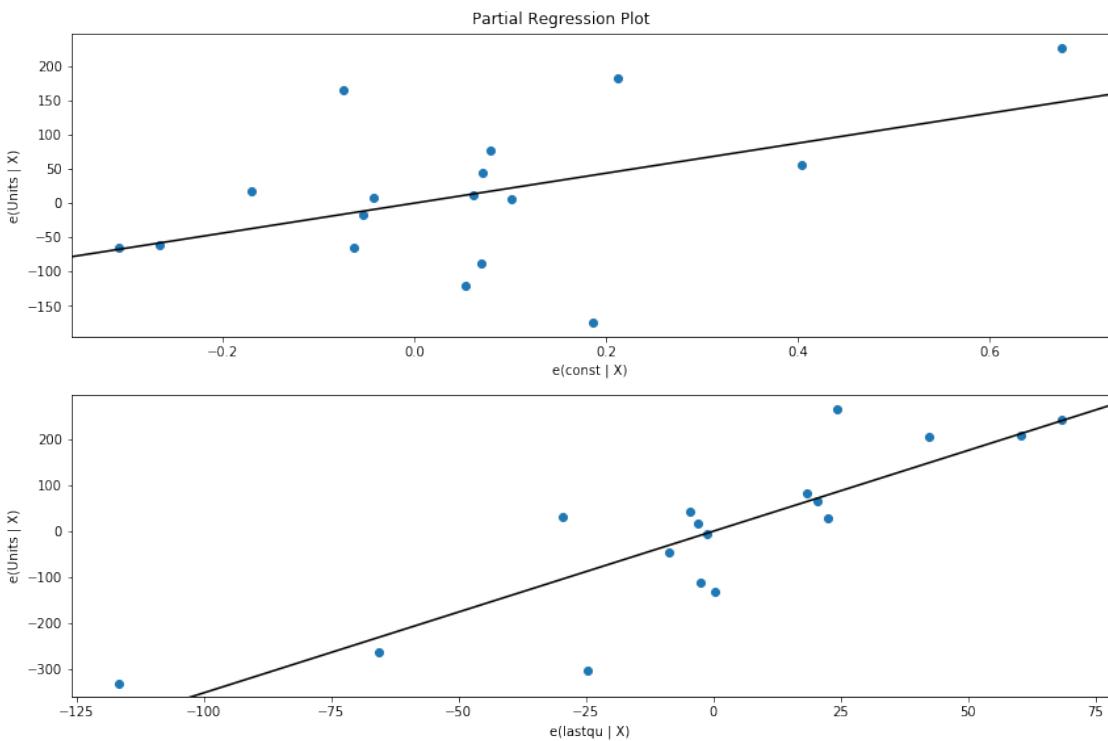
Wiregrass



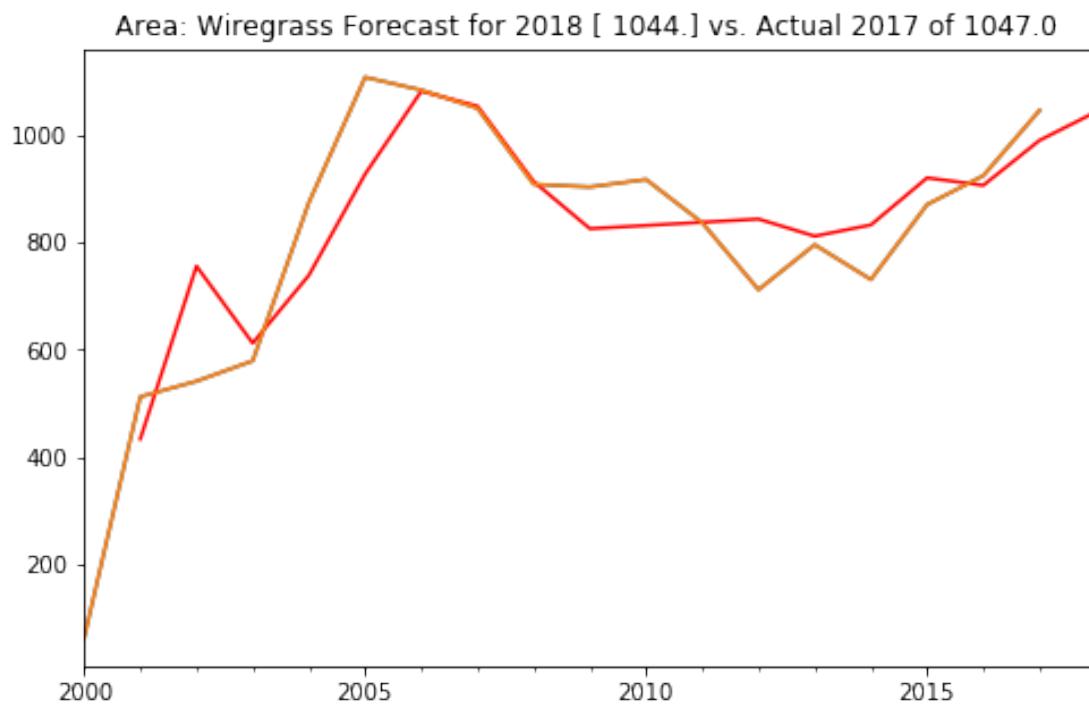
Wiregrass



## Wiregrass



Wiregrass



'Area fcast summary: Lake\_Martin\_Waterfront'

'Area regress: Lake\_Martin\_Waterfront'

```
<class 'statsmodels.iolib.summary.Summary'>
"""
                               OLS Regression Results
=====
Dep. Variable:                      Units      R-squared:                 0.668
Model:                          OLS      Adj. R-squared:            0.626
Method:                         Least Squares      F-statistic:             16.06
Date:                Mon, 29 Jan 2018      Prob (F-statistic):        0.00391
Time:                    16:57:55      Log-Likelihood:          -51.508
No. Observations:                  10      AIC:                     107.0
Df Residuals:                      8      BIC:                     107.6
Df Model:                           1
Covariance Type:            nonrobust
```

	coef	std err	t	P> t	[0.025	0.975]
<hr/>						
const	111.3631	37.313	2.985	0.017	25.320	197.406
lastqu	3.3497	0.836	4.008	0.004	1.422	5.277
<hr/>						
Omnibus:		1.708	Durbin-Watson:		2.319	
Prob(Omnibus):		0.426	Jarque-Bera (JB):		1.101	
Skew:		0.745	Prob(JB):		0.577	
Kurtosis:		2.348	Cond. No.		113.	
<hr/>						

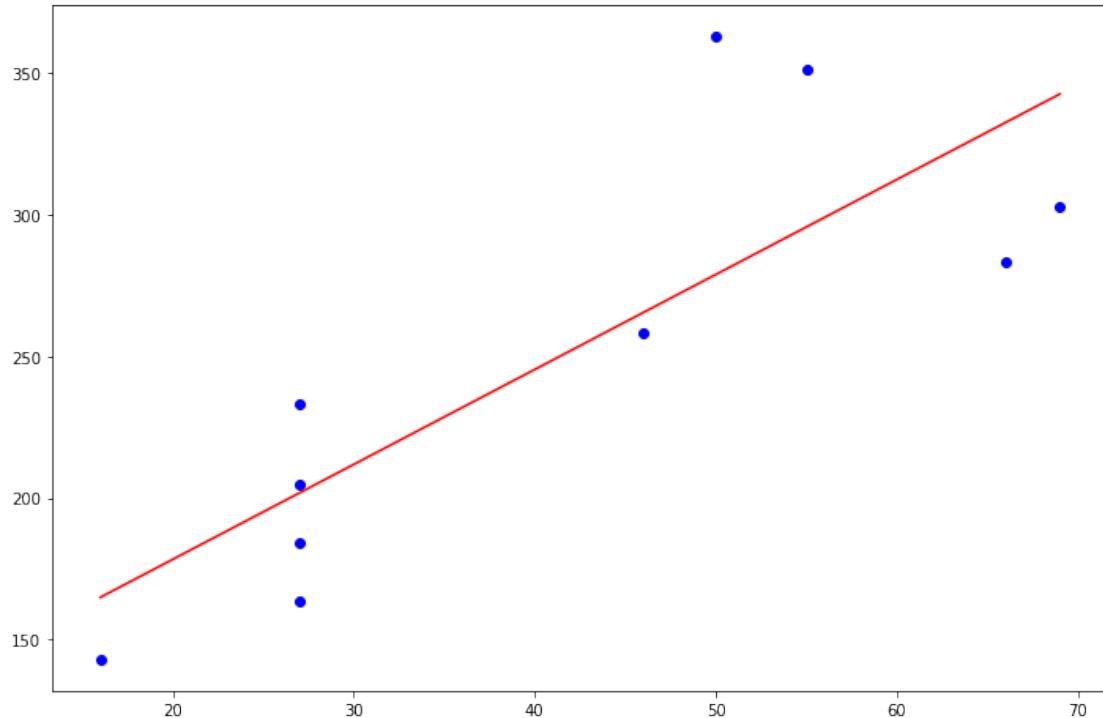
Warnings:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
"""

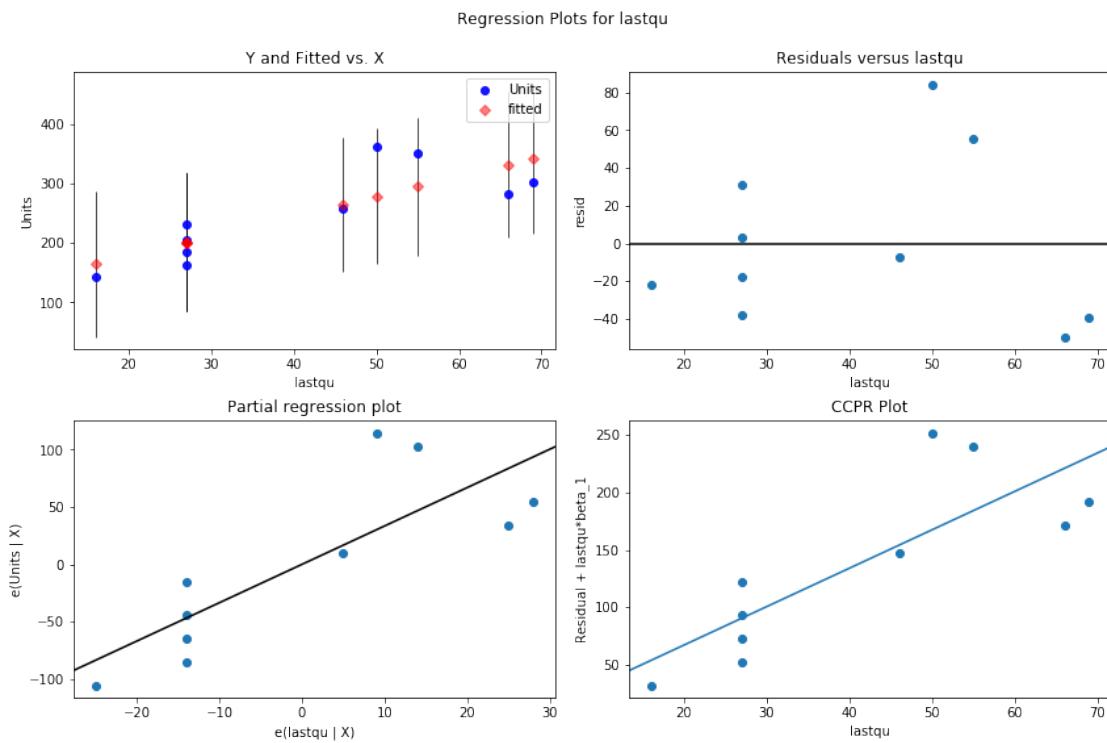
'Area Historical errors on Fcast: Lake\_Martin\_Waterfront'

'Area mergedfcast: Lake\_Martin\_Waterfront'

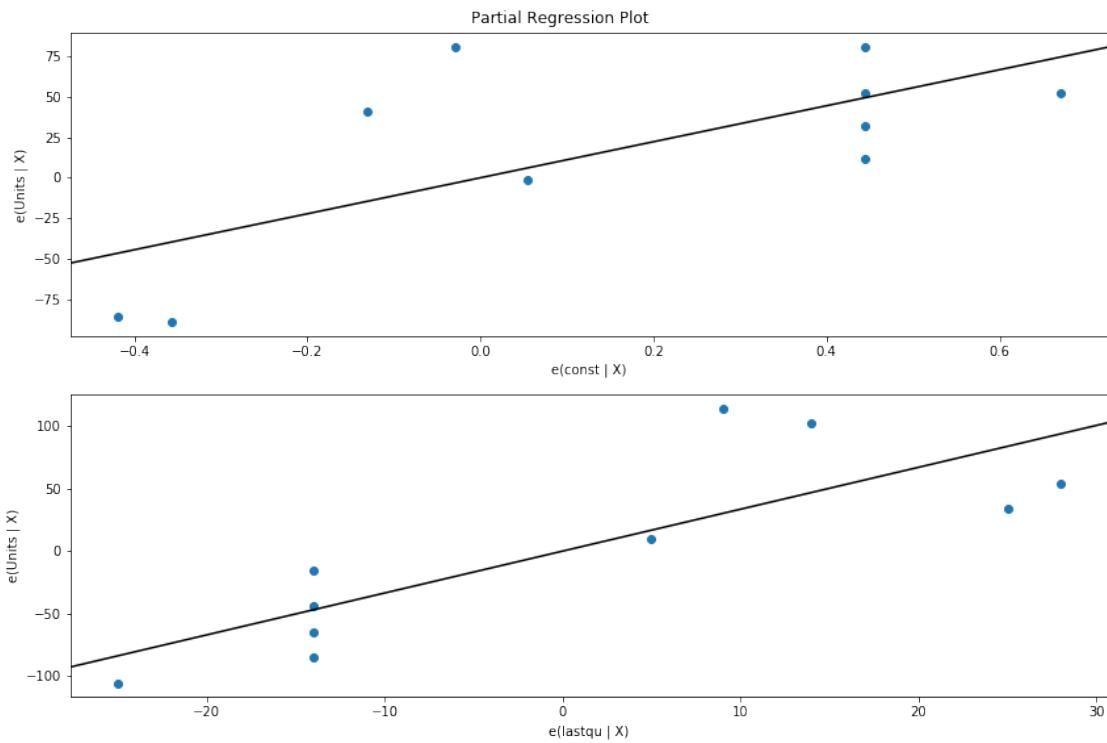
Lake\_Martin\_Waterfront



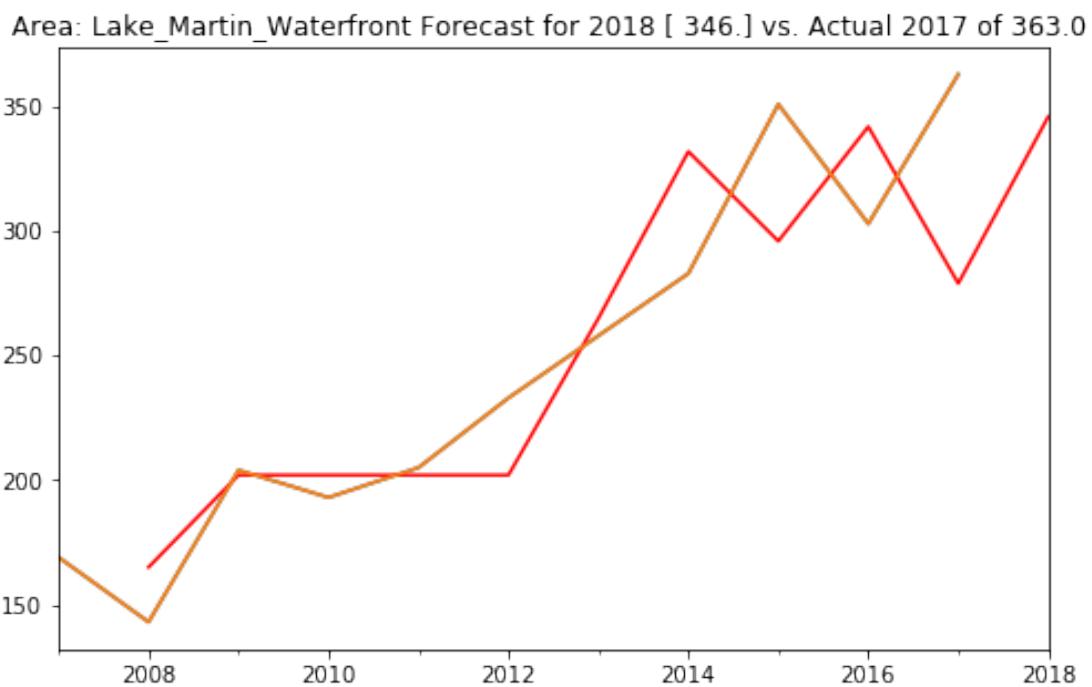
## Lake\_Martin\_Waterfront



## Lake\_Martin\_Waterfront



Lake\_Martin\_Waterfront



```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/frame.py:2746: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#  
    **kwargs)
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:337: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#  
    self.obj[key] = _infer_fill_value(value)
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:601: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#  
    self.obj[item_labels[indexer[info_axis]]] = value
```

#### Lake\_Martin\_Waterfront

		predictor	response							
		Units	predictor	Uperchg	lqperchg	fcast	errpercent	\		
2008-12-31		16.0	143.000000							
2009-12-31		27.0	163.666667							
2010-12-31		27.0	184.333333							
2011-12-31		27.0	205.000000							
2012-12-31		27.0	233.000000							
2013-12-31		46.0	258.000000							
2014-12-31		66.0	283.000000							
2015-12-31		55.0	351.000000							
2016-12-31		69.0	303.000000							
2017-12-31		50.0	363.000000							
2007-12-31	169.000000		NaN	NaN	NaN	NaN	NaN	\		
2008-12-31	143.000000		16.0	-15.38	NaN	165.0	13.33			
2009-12-31	163.666667		27.0	14.45	68.75	202.0	18.98			
2010-12-31	184.333333		27.0	12.63	0.00	202.0	8.75			
2011-12-31	205.000000		27.0	11.21	0.00	202.0	-1.49			
2012-12-31	233.000000		27.0	13.66	0.00	202.0	-15.35			
2013-12-31	258.000000		46.0	10.73	70.37	265.0	2.64			
2014-12-31	283.000000		66.0	9.69	43.48	332.0	14.76			
2015-12-31	351.000000		55.0	24.03	-16.67	296.0	-18.58			
2016-12-31	303.000000		69.0	-13.68	25.45	342.0	11.40			
2017-12-31	363.000000		50.0	19.80	-27.54	279.0	-30.11			
2018-12-31		NaN	70.0	NaN	40.00	346.0	NaN			

	nfcast	fctperchg
2007-12-31	NaN	NaN
2008-12-31	NaN	NaN
2009-12-31	175.0	NaN
2010-12-31	164.0	NaN
2011-12-31	184.0	NaN
2012-12-31	205.0	NaN
2013-12-31	306.0	NaN
2014-12-31	323.0	NaN
2015-12-31	252.0	NaN
2016-12-31	406.0	NaN
2017-12-31	247.0	NaN
2018-12-31	450.0	-4.68
		NaN
2007-12-31	146.394935	
2008-12-31	193.780293	
2009-12-31	193.780293	
2010-12-31	193.780293	
2011-12-31	193.780293	
2012-12-31	193.780293	
2013-12-31	308.000142	
2014-12-31	310.009742	
2015-12-31	335.461026	
2016-12-31	287.776544	
2017-12-31	324.236437	
2018-12-31	278.659071	

dtype: float64

POLY2 SUMMARY:

### OLS Regression Results

Dep. Variable:	response	R-squared:	0.801
Model:	OLS	Adj. R-squared:	0.744
Method:	Least Squares	F-statistic:	14.09
Date:	Mon, 29 Jan 2018	Prob (F-statistic):	0.00352
Time:	16:57:56	Log-Likelihood:	-48.942
No. Observations:	10	AIC:	103.9
Df Residuals:	7	BIC:	104.8
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-64.1079	86.659	-0.740	0.484	-269.023	140.807
predictor	13.0953	4.550	2.878	0.024	2.336	23.855
I(predictor ** 2.0)	-0.1124	0.052	-2.167	0.067	-0.235	0.010

Omnibus:	1.482	Durbin-Watson:	1.875
Prob(Omnibus):	0.477	Jarque-Bera (JB):	0.744
Skew:	0.111	Prob(JB):	0.689
Kurtosis:	1.683	Cond. No.	1.79e+04

=====

Warnings:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 1.79e+04. This might indicate that there are strong multicollinearity or other numerical problems.

POLY3 SUMMARY:

OLS Regression Results

=====

Dep. Variable:	response	R-squared:	0.850
Model:	OLS	Adj. R-squared:	0.775
Method:	Least Squares	F-statistic:	11.32
Date:	Mon, 29 Jan 2018	Prob (F-statistic):	0.00698
Time:	16:57:56	Log-Likelihood:	-47.535
No. Observations:	10	AIC:	103.1
Df Residuals:	6	BIC:	104.3
Df Model:	3		
Covariance Type:	nonrobust		

=====

	coef	std err	t	P> t	[0.025	0.975]
Intercept	184.8163	195.968	0.943	0.382	-294.700	664.333
predictor	-8.1773	15.824	-0.517	0.624	-46.898	30.543
I(predictor ** 2.0)	0.4277	0.390	1.097	0.315	-0.526	1.382
I(predictor ** 3.0)	-0.0042	0.003	-1.396	0.212	-0.011	0.003

=====

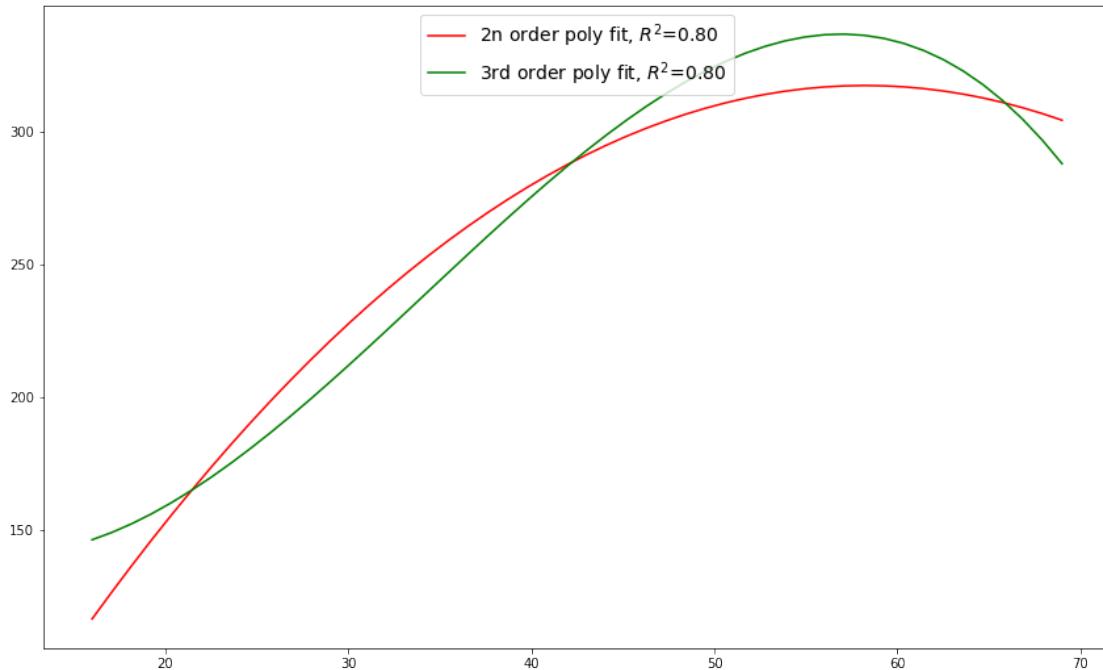
Omnibus:	0.438	Durbin-Watson:	1.676
Prob(Omnibus):	0.803	Jarque-Bera (JB):	0.494
Skew:	-0.206	Prob(JB):	0.781
Kurtosis:	1.993	Cond. No.	2.69e+06

=====

Warnings:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 2.69e+06. This might indicate that there are strong multicollinearity or other numerical problems.

/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis  
"anyway, n=%i" % int(n))



```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/frame.py:2746: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#**kwargs)
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:337: SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#
    self.obj[key] = _infer_fill_value(value)
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/pandas/core/indexing.py:601: SettingWithCopyWarning
```

```
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#
    self.obj[item_labels[indexer[info_axis]]] = value
```

```
/home/tom/anaconda3/lib/python3.6/site-packages/scipy/stats/stats.py:1334: UserWarning: kurtosis
    "anyway, n=%i" % int(n))
```

```
Lake_Martin_Waterfront
predictor      response
2008-12-31      16.0   143.000000
2009-12-31      27.0   163.666667
```

2010-12-31	27.0	184.333333
2011-12-31	27.0	205.000000
2012-12-31	27.0	233.000000
2013-12-31	46.0	258.000000
2014-12-31	66.0	283.000000
2015-12-31	55.0	351.000000
2016-12-31	69.0	303.000000
2017-12-31	50.0	363.000000

POLY2 SUMMARY:

OLS Regression Results

Dep. Variable:	response	R-squared:	0.801
Model:	OLS	Adj. R-squared:	0.744
Method:	Least Squares	F-statistic:	14.09
Date:	Mon, 29 Jan 2018	Prob (F-statistic):	0.00352
Time:	16:57:56	Log-Likelihood:	-48.942
No. Observations:	10	AIC:	103.9
Df Residuals:	7	BIC:	104.8
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
Intercept	-64.1079	86.659	-0.740	0.484	-269.023	140.807
predictor	13.0953	4.550	2.878	0.024	2.336	23.855
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Omnibus:	1.482	Durbin-Watson:	1.875
Prob(Omnibus):	0.477	Jarque-Bera (JB):	0.744
Skew:	0.111	Prob(JB):	0.689
Kurtosis:	1.683	Cond. No.	1.79e+04

## Warnings:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 1.79e+04. This might indicate that there are strong multicollinearity or other numerical problems.

POLY3 SUMMARY:

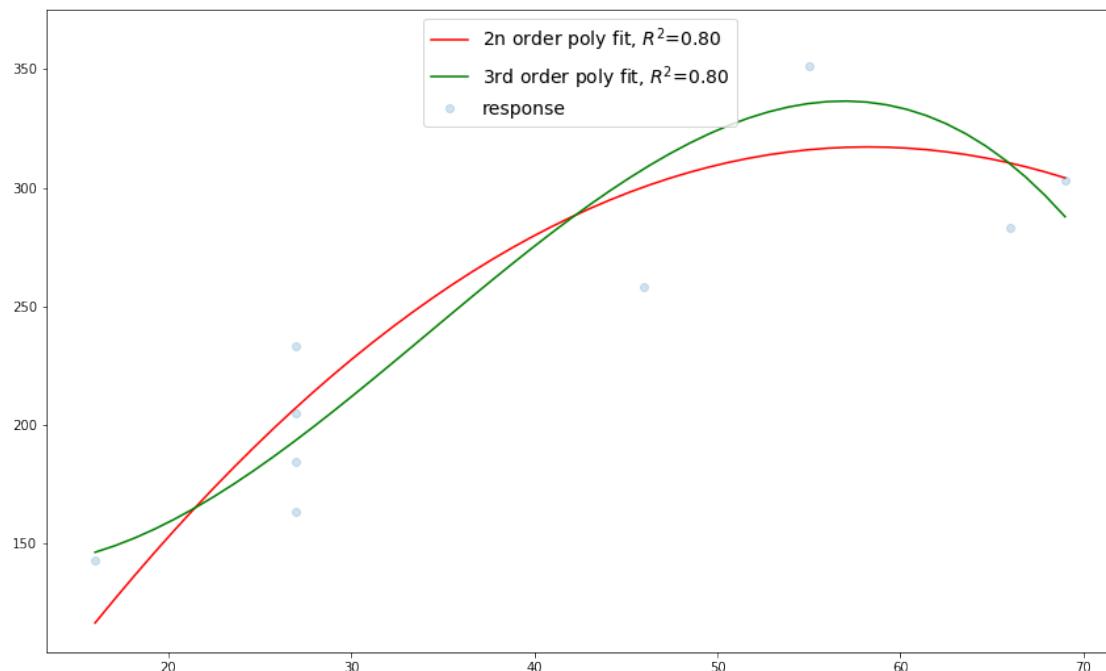
OLS Regression Results

Dep. Variable:	response	R-squared:	0.850
Model:	OLS	Adj. R-squared:	0.775
Method:	Least Squares	F-statistic:	11.32
Date:	Mon, 29 Jan 2018	Prob (F-statistic):	0.00698
Time:	16:57:56	Log-Likelihood:	-47.535
No. Observations:	10	AIC:	103.1
Df Residuals:	6	BIC:	104.3
Df Model:	3		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
<hr/>						
Intercept	184.8163	195.968	0.943	0.382	-294.700	664.333
predictor	-8.1773	15.824	-0.517	0.624	-46.898	30.543
I(predictor ** 2.0)	0.4277	0.390	1.097	0.315	-0.526	1.382
I(predictor ** 3.0)	-0.0042	0.003	-1.396	0.212	-0.011	0.003
<hr/>						
Omnibus:	0.438	Durbin-Watson:			1.676	
Prob(Omnibus):	0.803	Jarque-Bera (JB):			0.494	
Skew:	-0.206	Prob(JB):			0.781	
Kurtosis:	1.993	Cond. No.			2.69e+06	
<hr/>						

Warnings:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 2.69e+06. This might indicate that there are strong multicollinearity or other numerical problems.



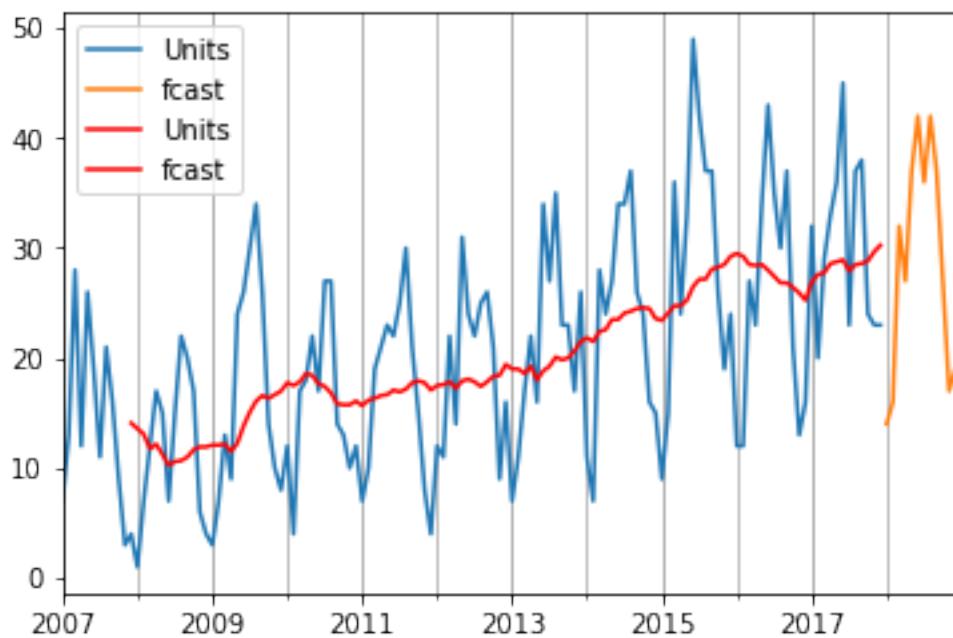
Lake\_Martin\_Waterfront



Lake\_Martin\_Waterfront

```
/home/tom/anaconda3/lib/python3.6/site-packages/ipykernel/_main_.py:4: FutureWarning: pd.rolling  
DataFrame.rolling(window=12,center=False).mean()
```

```
<matplotlib.figure.Figure at 0x7fa12192e588>
```



To suppress the code cells (only input) a custom template can be used. Similar as discussed in this question, a template e.g. `latex_nocode.tplx` has to be created (in the working directory) with the following content (`((- extends 'latex_article.tplx' -)) % Disable input cells ((* block input_group )) (( endblock input_group *))`) use this template like `ipython nbconvert --to=latex --template=latex_nocode.tplx --post=pdf file.ipynb`