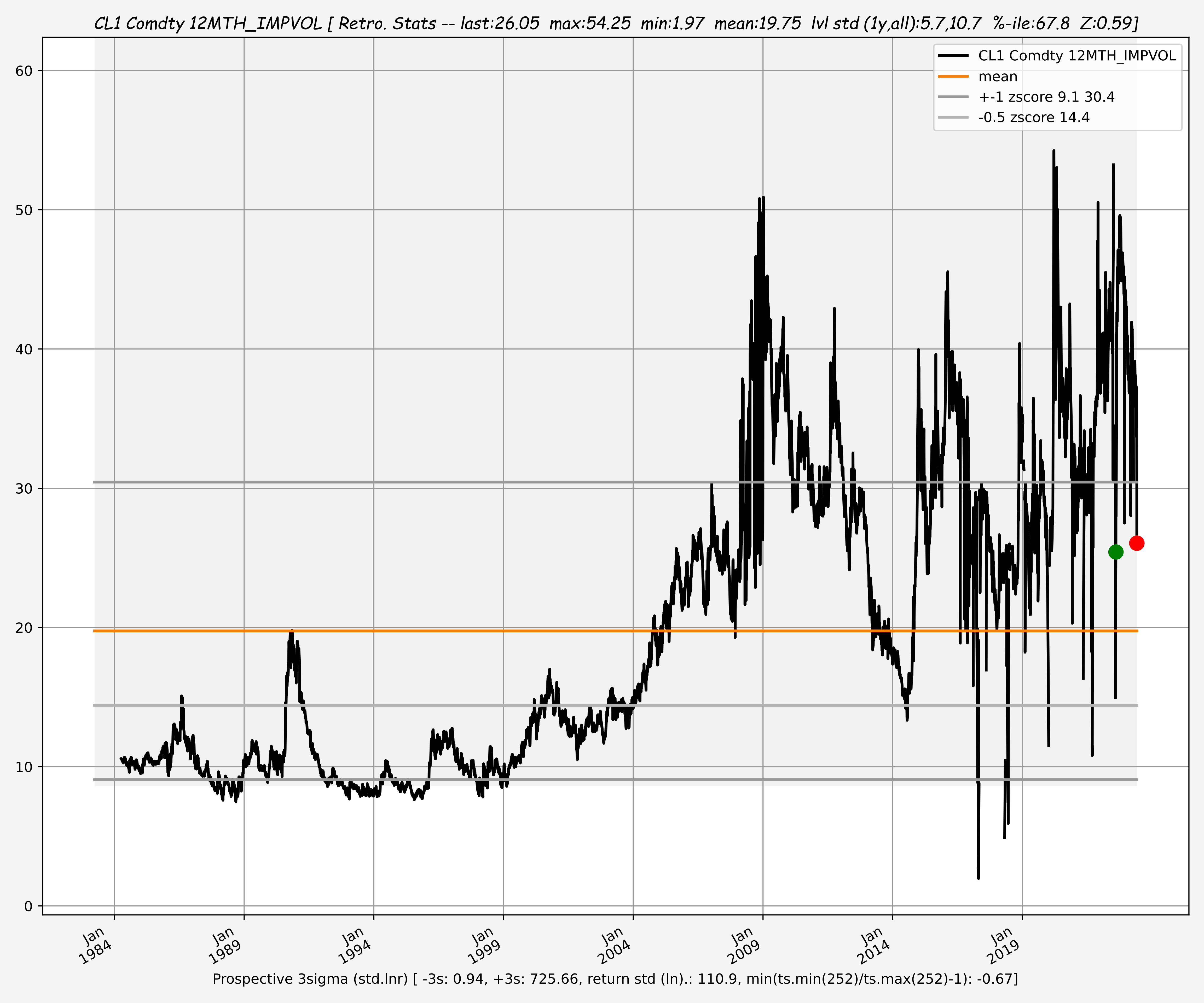
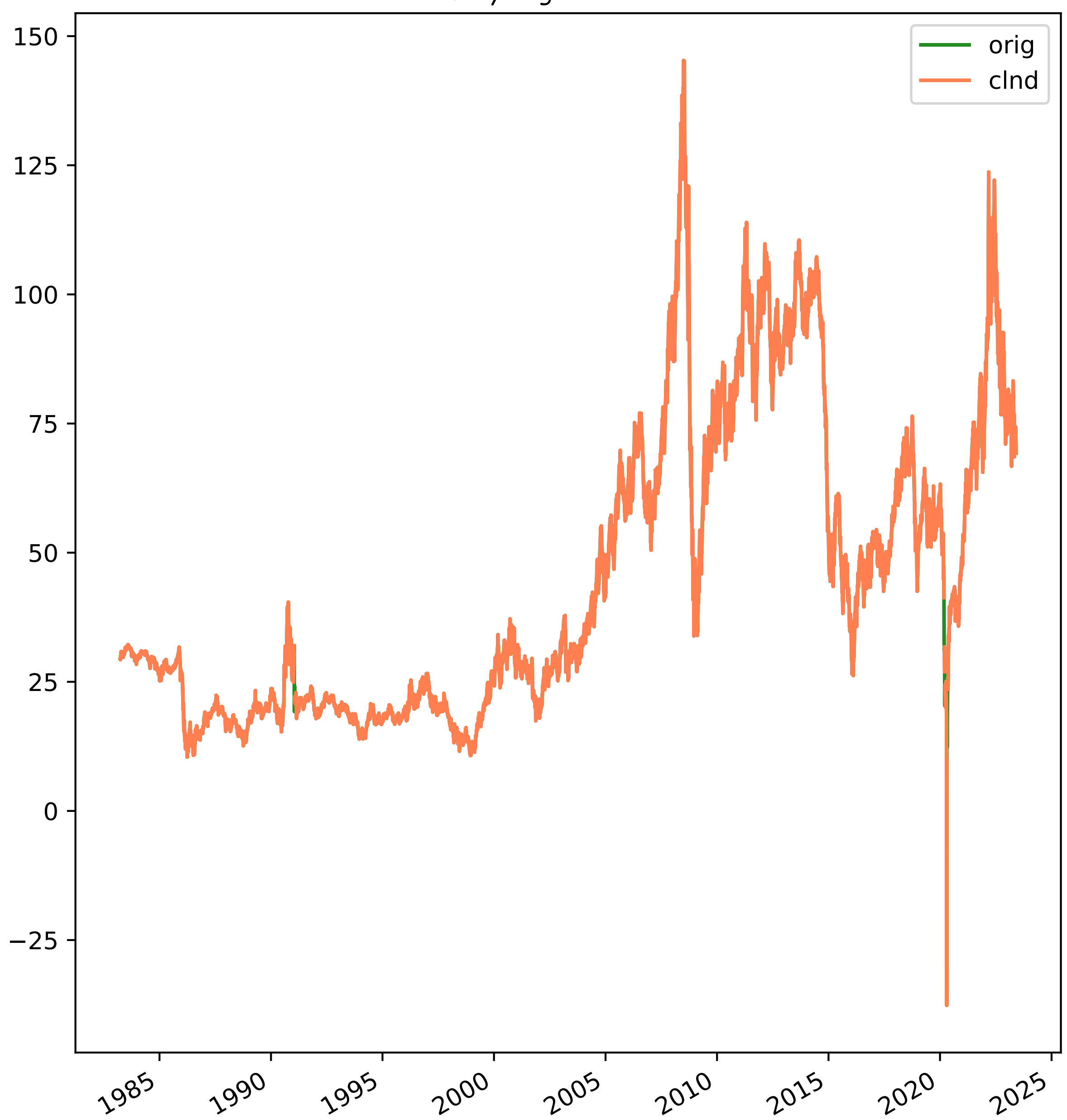
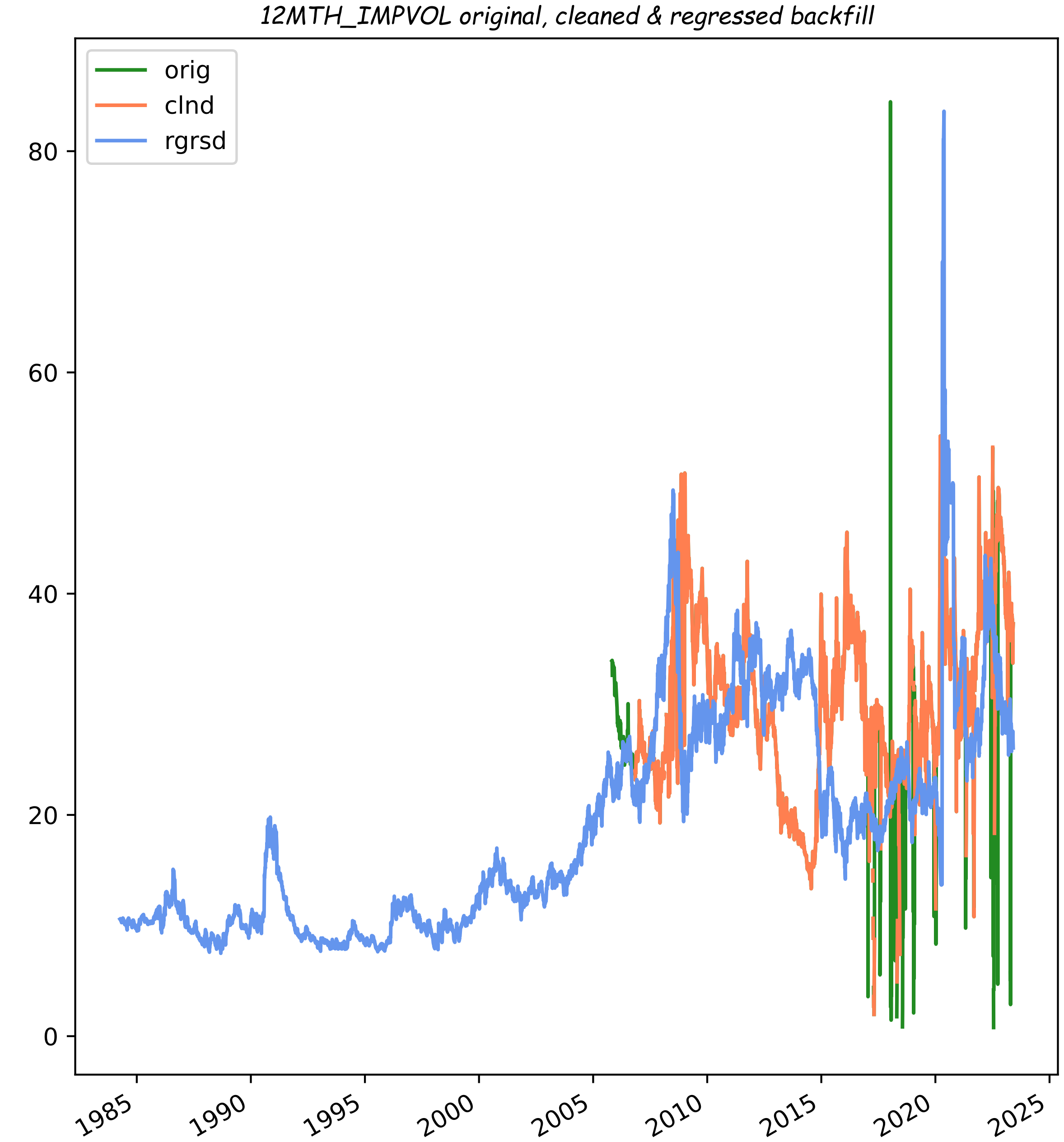


CL1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:26.05 max:54.25 min:1.97 mean:19.75 lvl std (1y,all):5.7,10.7 %-ile:67.8 Z:0.59]
CL1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 9.1 30.4
-0.5 zscore 14.4
0
10
20
30
40
50
60
Jan 1984
Jan 1989
Jan 1994
Jan 1999
Jan 2004
Jan 2009
Jan 2014
Jan 2019
Prospective 3sigma (std.lnr) [-3s: 0.94, +3s: 725.66, return std (ln).: 110.9, min(ts.min(252)/ts.max(252)-1): -0.67]

CL1 Comdty original & cleaned data



12MTH_IMPVOL original, cleaned & regressed backfill



	CL1 Comdty
count	10048.000
mean	45.380
std	28.919
min	-37.630
25%	20.340
50%	31.940
75%	66.035
max	145.290

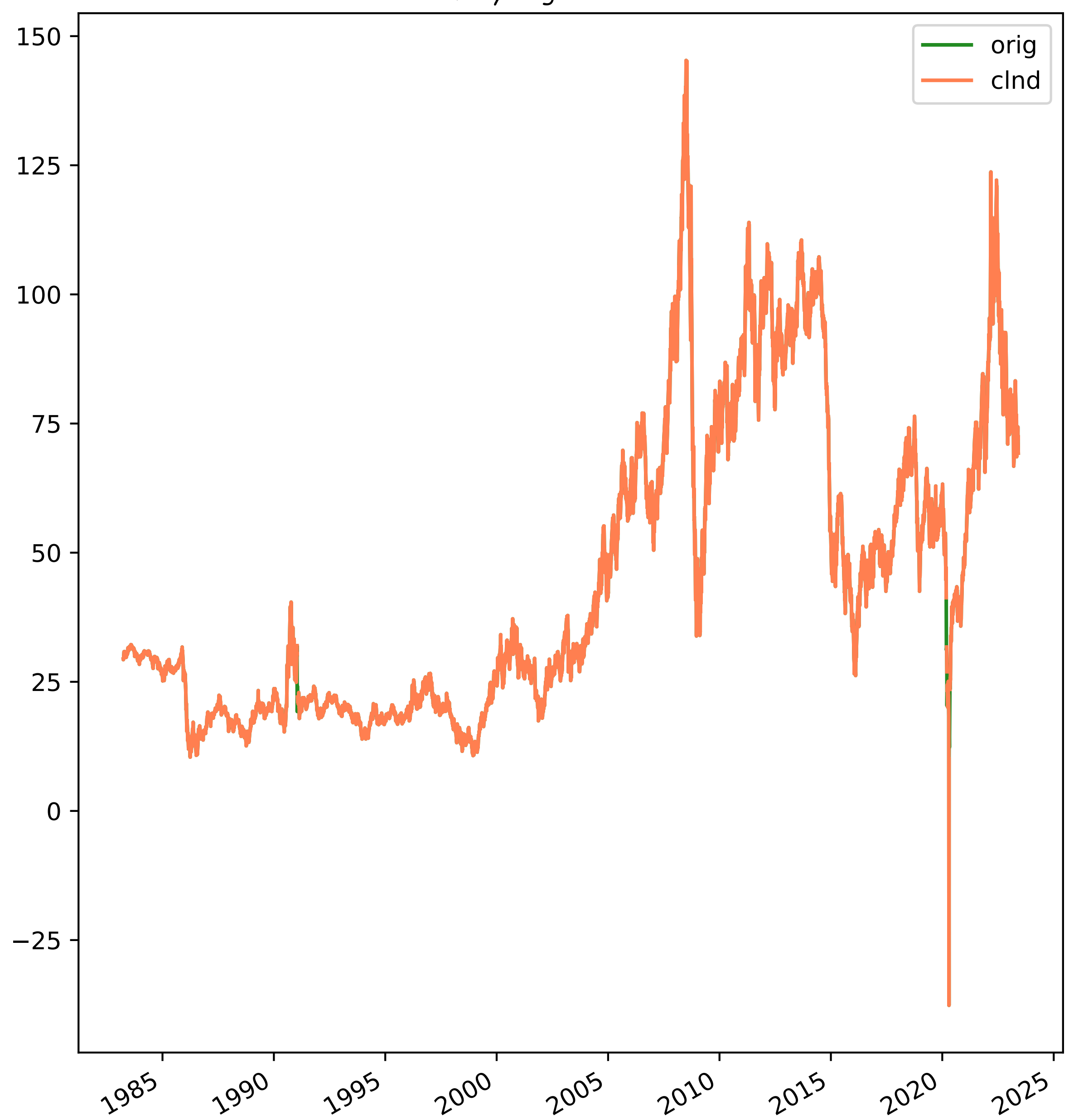
	12MTH_IMPVOL
count	9821.000
mean	19.024
std	9.971
min	7.491
25%	10.383
50%	15.943
75%	26.053
max	83.609

```
                            OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.884
Model:                            OLS   Adj. R-squared (uncentered):              0.884
Method:                 Least Squares   F-statistic:                              6252.
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:07   Log-Likelihood:                         -15584.
No. Observations:                4116   AIC:                                  3.118e+04
Df Residuals:                    4111   BIC:                                  3.121e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.3089      0.003    121.991      0.000       0.304       0.314
x2             0.0352      0.003     13.607      0.000       0.030       0.040
x3             0.0228      0.003      7.717      0.000       0.017       0.029
x4             0.0310      0.002     12.868      0.000       0.026       0.036
x5             0.0345      0.003     11.501      0.000       0.029       0.040
==============================================================================
Omnibus:                       15.465   Durbin-Watson:                   0.044
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               14.429
Skew:                          -0.111   Prob(JB):                     0.000736
Kurtosis:                       2.813   Cond. No.                         3.78
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

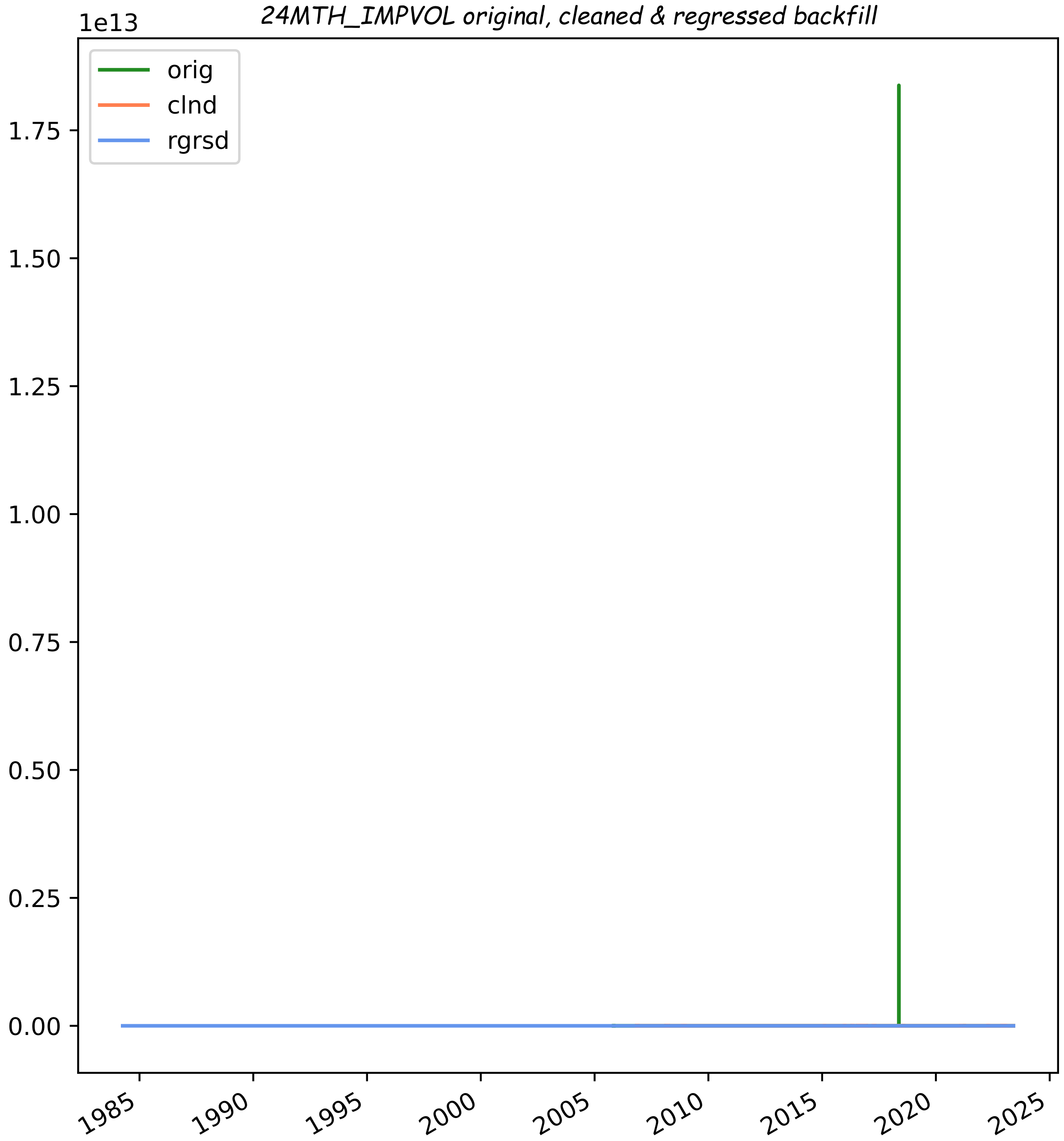
ADF Test of Resids.: -4.004 {5% -2.8622, 1% -3.4319	0		0
CL1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	03-30-1983	start	04-06-1984
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	1.356	total_return	1.462
cagr	0.022	cagr	0.023
max_drawdown	-1.259	max_drawdown	-0.724
calmar	0.017	calmar	0.032
mtd	-0.098	mtd	-0.078
three_month	-0.101	three_month	-0.092
six_month	-0.140	six_month	-0.144
ytd	-0.137	ytd	-0.133
one_year	-0.396	one_year	-0.367
three_year	0.251	three_year	-0.231
five_year	0.007	five_year	0.019
ten_year	-0.028	ten_year	-0.017
incep	0.022	incep	0.023
daily_sharpe	0.019	daily_sharpe	0.197
daily_sortino	0.023	daily_sortino	0.634
daily_mean	0.013	daily_mean	0.104
daily_vol	0.682	daily_vol	0.531
daily_skew	-35.496	daily_skew	55.232
daily_kurt	2738.418	daily_kurt	4480.504
best_day	1.353	best_day	2.722
worst_day	-3.060	worst_day	-0.249
monthly_sharpe	0.222	monthly_sharpe	0.171
monthly_sortino	0.549	monthly_sortino	0.781
monthly_mean	0.118	monthly_mean	0.120
monthly_vol	0.532	monthly_vol	0.702
monthly_skew	9.280	monthly_skew	17.392
monthly_kurt	154.991	monthly_kurt	349.710
best_month	2.545	best_month	4.080
worst_month	-0.542	worst_month	-0.303
yearly_sharpe	0.217	yearly_sharpe	0.219
yearly_sortino	0.506	yearly_sortino	0.452
yearly_mean	0.077	yearly_mean	0.053
yearly_vol	0.354	yearly_vol	0.243
yearly_skew	0.708	yearly_skew	0.351
yearly_kurt	0.689	yearly_kurt	0.716
best_year	1.124	best_year	0.722
worst_year	-0.535	worst_year	-0.449
avg_drawdown	-0.088	avg_drawdown	-0.072
avg_drawdown_days	216.060	avg_drawdown_days	171.756
avg_up_month	0.082	avg_up_month	0.075
avg_down_month	-0.075	avg_down_month	-0.055
win_year_perc	0.600	win_year_perc	0.590
twelve_month_win_perc	0.542	twelve_month_win_perc	0.542


CL1 Comdty 24MTH_IMPVOL [Retro. Stats -- last:22.60 max:43.47 min:6.38 mean:17.03 lvl std (1y,all):3.4,9.0 %-ile:66.4 Z:0.62]
CL1 Comdty 24MTH_IMPVOL
mean
+-1 zscore 8.0 26.0
-0.5 zscore 12.5
10
20
30
40
Jan 1984
Jan 1989
Jan 1994
Jan 1999
Jan 2004
Jan 2009
Jan 2014
Jan 2019
Prospective 3sigma (std.lnr) [-3s: 2.71, +3s: 188.56, return std (ln).: 70.7, min(ts.min(252)/ts.max(252)-1): -0.59]

CL1 Comdty original & cleaned data



24MTH_IMPVOL original, cleaned & regressed backfill



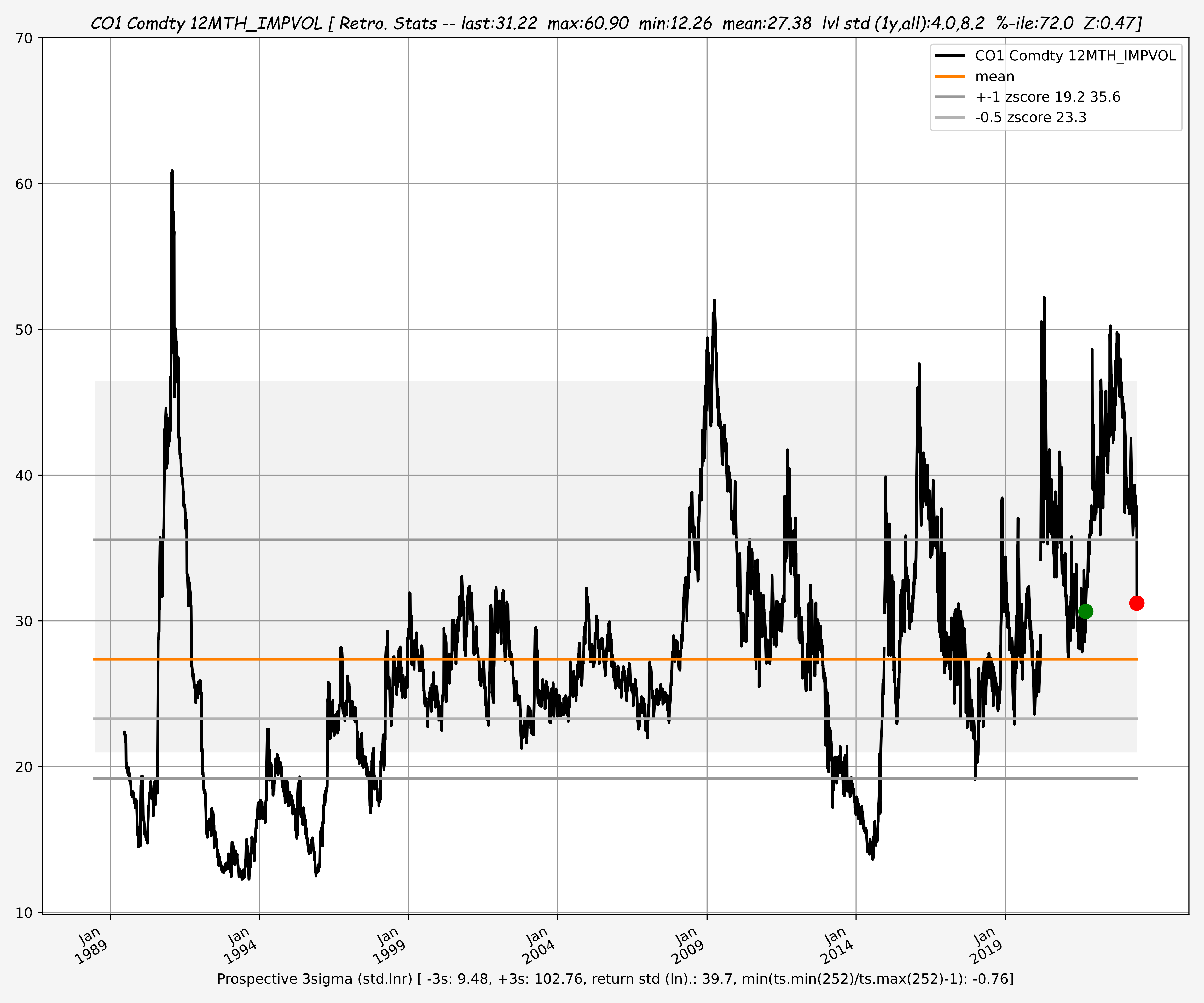
	CL1 Comdty
count	10048.000
mean	45.380
std	28.919
min	-37.630
25%	20.340
50%	31.940
75%	66.035
max	145.290

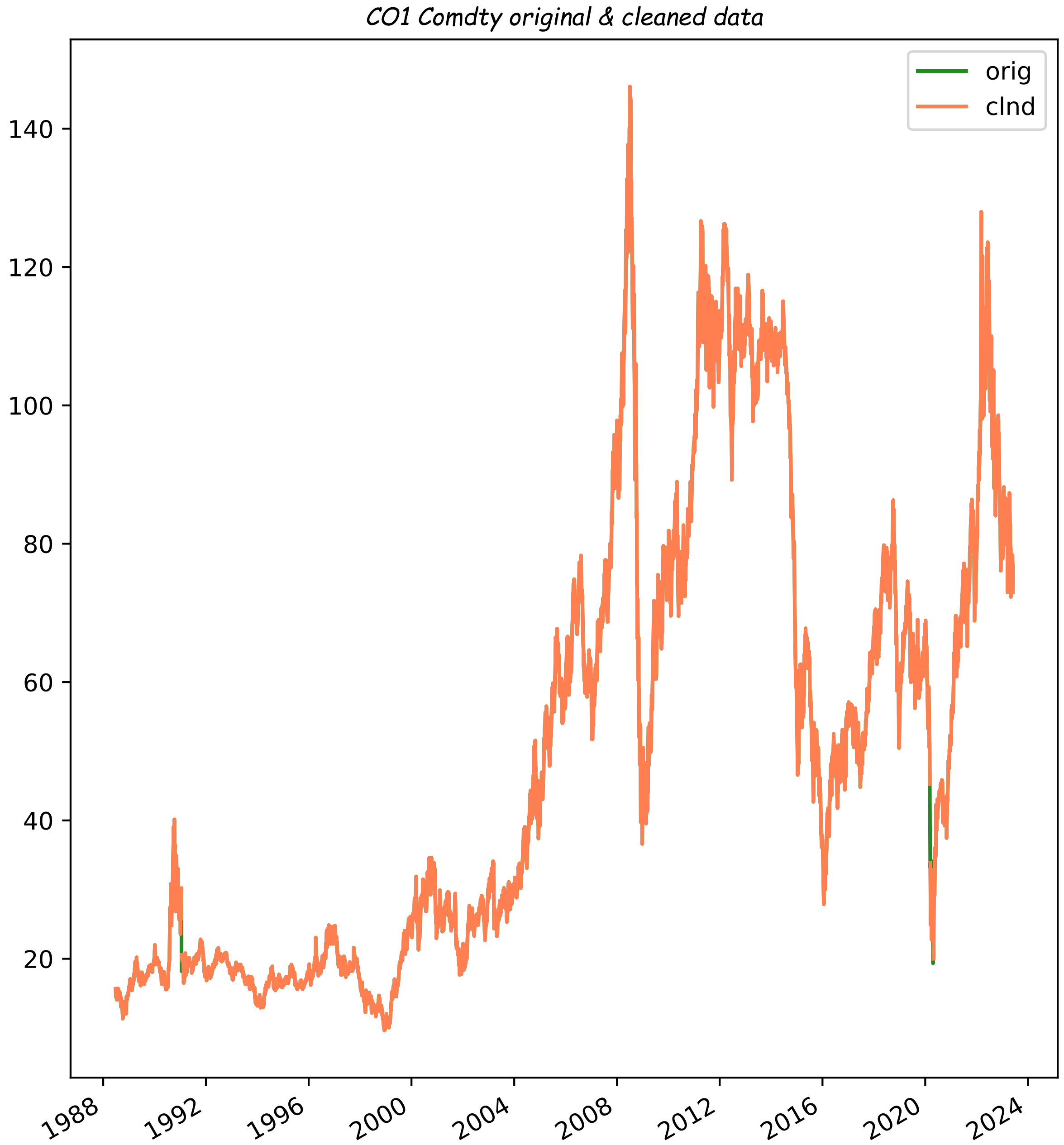
	24MTH_IMPVOL
count	9821.000
mean	16.393
std	8.642
min	6.380
25%	8.915
50%	13.564
75%	22.677
max	62.834

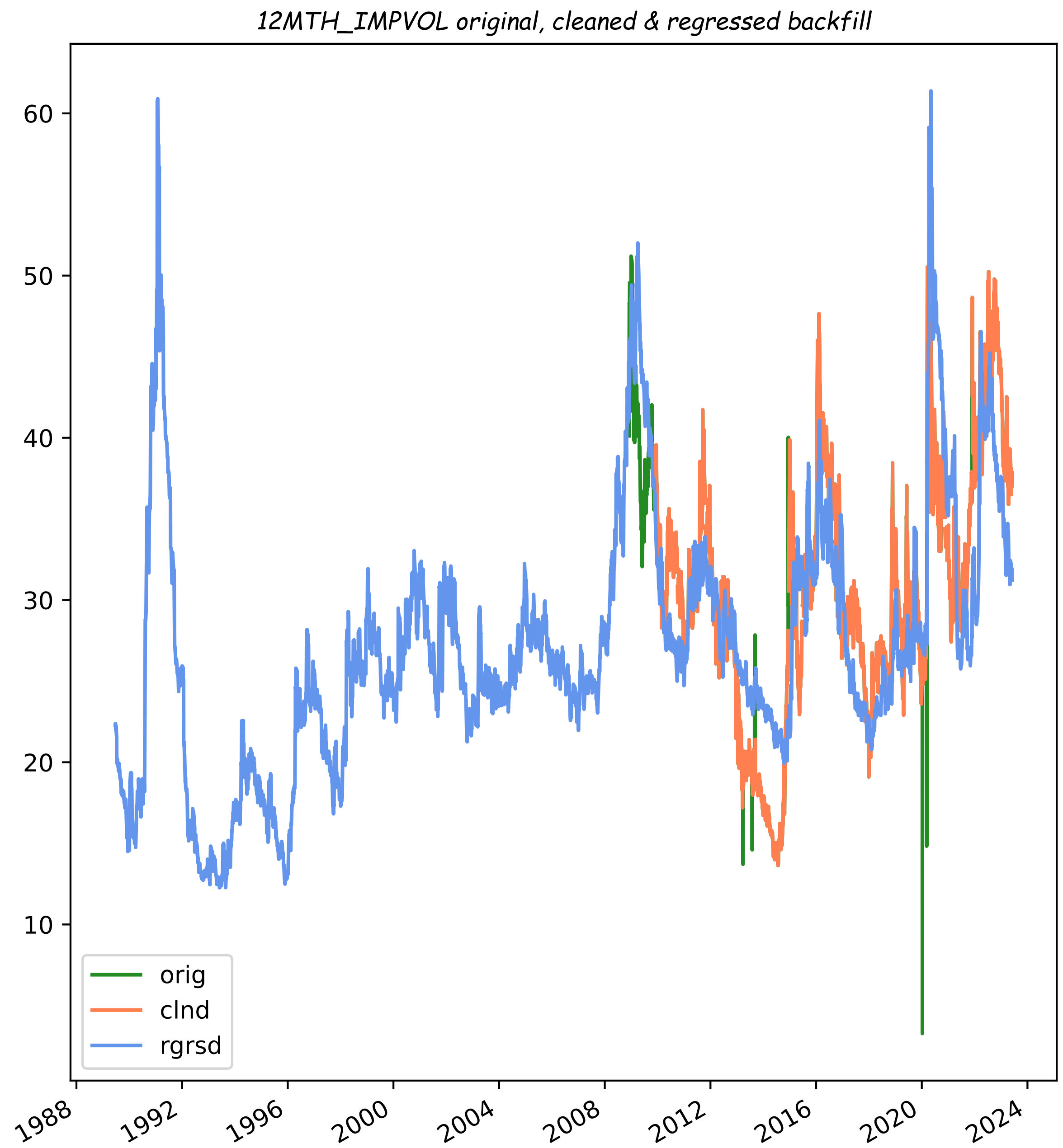
```
                            OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.905
Model:                            OLS   Adj. R-squared (uncentered):              0.905
Method:                 Least Squares   F-statistic:                              7826.
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:09   Log-Likelihood:                         -14524.
No. Observations:                4115   AIC:                                  2.906e+04
Df Residuals:                    4110   BIC:                                  2.909e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.2733      0.002    139.953      0.000       0.269       0.277
x2             0.0234      0.002     11.678      0.000       0.019       0.027
x3             0.0186      0.002      8.153      0.000       0.014       0.023
x4             0.0259      0.002     13.909      0.000       0.022       0.030
x5             0.0298      0.002     12.817      0.000       0.025       0.034
==============================================================================
Omnibus:                       84.586   Durbin-Watson:                   0.030
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               74.835
Skew:                          -0.275   Prob(JB):                     5.62e-17
Kurtosis:                       2.634   Cond. No.                         3.77
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

ADF Test of Resids.: -3.706 {5% -2.8622, 1% -3.4320

	0		0
CL1 Comdty Stats	Value	24MTH_IMPVOL Stats	Value
start	03-30-1983	start	04-06-1984
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	1.356	total_return	1.436
cagr	0.022	cagr	0.023
max_drawdown	-1.259	max_drawdown	-0.742
calmar	0.017	calmar	0.031
mtd	-0.098	mtd	-0.081
three_month	-0.101	three_month	-0.095
six_month	-0.140	six_month	-0.145
ytd	-0.137	ytd	-0.136
one_year	-0.396	one_year	-0.370
three_year	0.251	three_year	-0.208
five_year	0.007	five_year	0.018
ten_year	-0.028	ten_year	-0.018
incep	0.022	incep	0.023
daily_sharpe	0.019	daily_sharpe	0.203
daily_sortino	0.023	daily_sortino	0.577
daily_mean	0.013	daily_mean	0.095
daily_vol	0.682	daily_vol	0.466
daily_skew	-35.496	daily_skew	43.907
daily_kurt	2738.418	daily_kurt	3270.942
best_day	1.353	best_day	2.209
worst_day	-3.060	worst_day	-0.218
monthly_sharpe	0.222	monthly_sharpe	0.173
monthly_sortino	0.549	monthly_sortino	0.721
monthly_mean	0.118	monthly_mean	0.109
monthly_vol	0.532	monthly_vol	0.632
monthly_skew	9.280	monthly_skew	16.616
monthly_kurt	154.991	monthly_kurt	329.144
best_month	2.545	best_month	3.620
worst_month	-0.542	worst_month	-0.301
yearly_sharpe	0.217	yearly_sharpe	0.220
yearly_sortino	0.506	yearly_sortino	0.449
yearly_mean	0.077	yearly_mean	0.054
yearly_vol	0.354	yearly_vol	0.244
yearly_skew	0.708	yearly_skew	0.249
yearly_kurt	0.689	yearly_kurt	0.355
best_year	1.124	best_year	0.692
worst_year	-0.535	worst_year	-0.439
avg_drawdown	-0.088	avg_drawdown	-0.071
avg_drawdown_days	216.060	avg_drawdown_days	178.253
avg_up_month	0.082	avg_up_month	0.071
avg_down_month	-0.075	avg_down_month	-0.055
win_year_perc	0.600	win_year_perc	0.590
twelve_month_win_perc	0.542	twelve_month_win_perc	0.545


CO1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:31.22 max:60.90 min:12.26 mean:27.38 lvl std (1y,all):4.0,8.2 %-ile:72.0 Z:0.47]
CO1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 19.2 35.6
-0.5 zscore 23.3
70
60
50
40
30
20
10
Jan 1989
Jan 1994
Jan 1999
Jan 2004
Jan 2009
Jan 2014
Jan 2019
Prospective 3sigma (std.lnr) [-3s: 9.48, +3s: 102.76, return std (ln).: 39.7, min(ts.min(252)/ts.max(252)-1): -0.76]





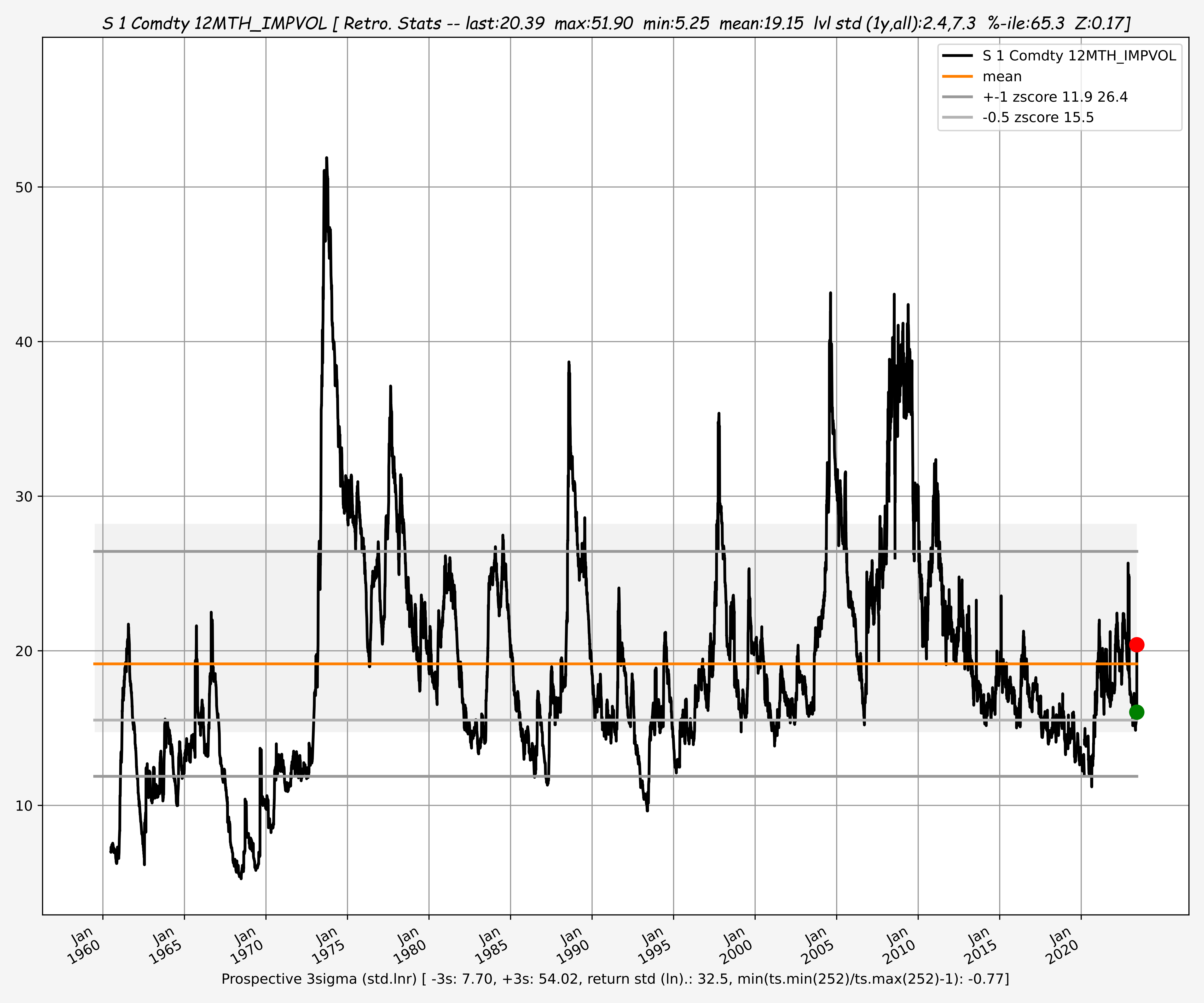
	CO1 Comdty
count	8909.000
mean	50.580
std	33.029
min	9.640
25%	19.530
50%	44.500
75%	73.400
max	146.080

	12MTH_IMPVOL
count	8673.000
mean	27.218
std	7.824
min	12.263
25%	23.183
50%	26.295
75%	30.807
max	61.383

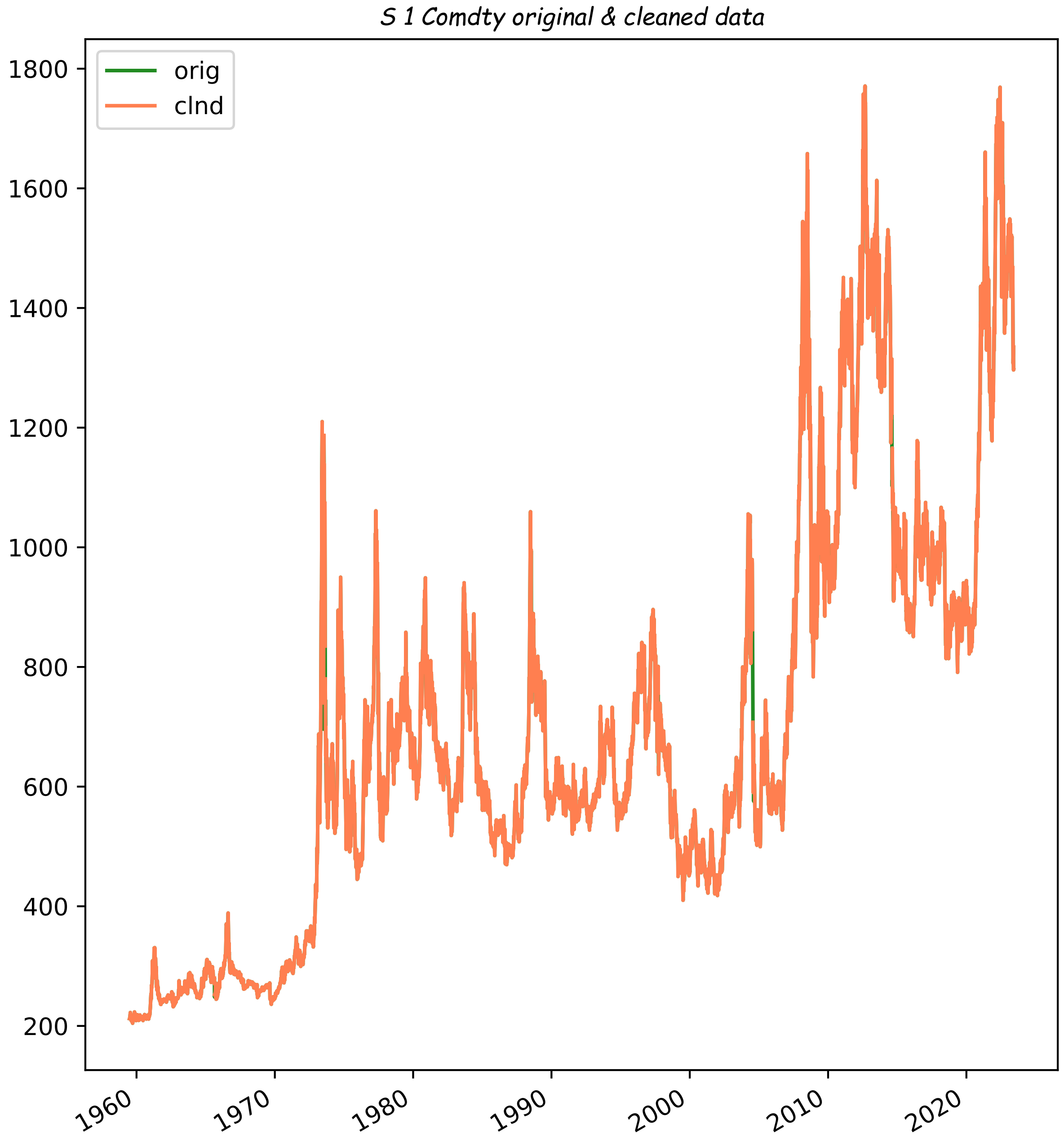
```
                               OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.973
Model:                            OLS   Adj. R-squared (uncentered):              0.973
Method:                 Least Squares   F-statistic:                          2.515e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:10   Log-Likelihood:                         -10452.
No. Observations:                3430   AIC:                                  2.091e+04
Df Residuals:                    3425   BIC:                                  2.094e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.1183      0.002     62.546      0.000       0.115       0.122
x2             0.1626      0.008     20.518      0.000       0.147       0.178
x3             0.0621      0.010      6.093      0.000       0.042       0.082
x4             0.1199      0.008     15.529      0.000       0.105       0.135
x5             0.2913      0.011     26.085      0.000       0.269       0.313
==============================================================================
Omnibus:                       43.286   Durbin-Watson:                   0.041
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               44.714
Skew:                          -0.270   Prob(JB):                     1.95e-10
Kurtosis:                       3.148   Cond. No.                         16.3
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

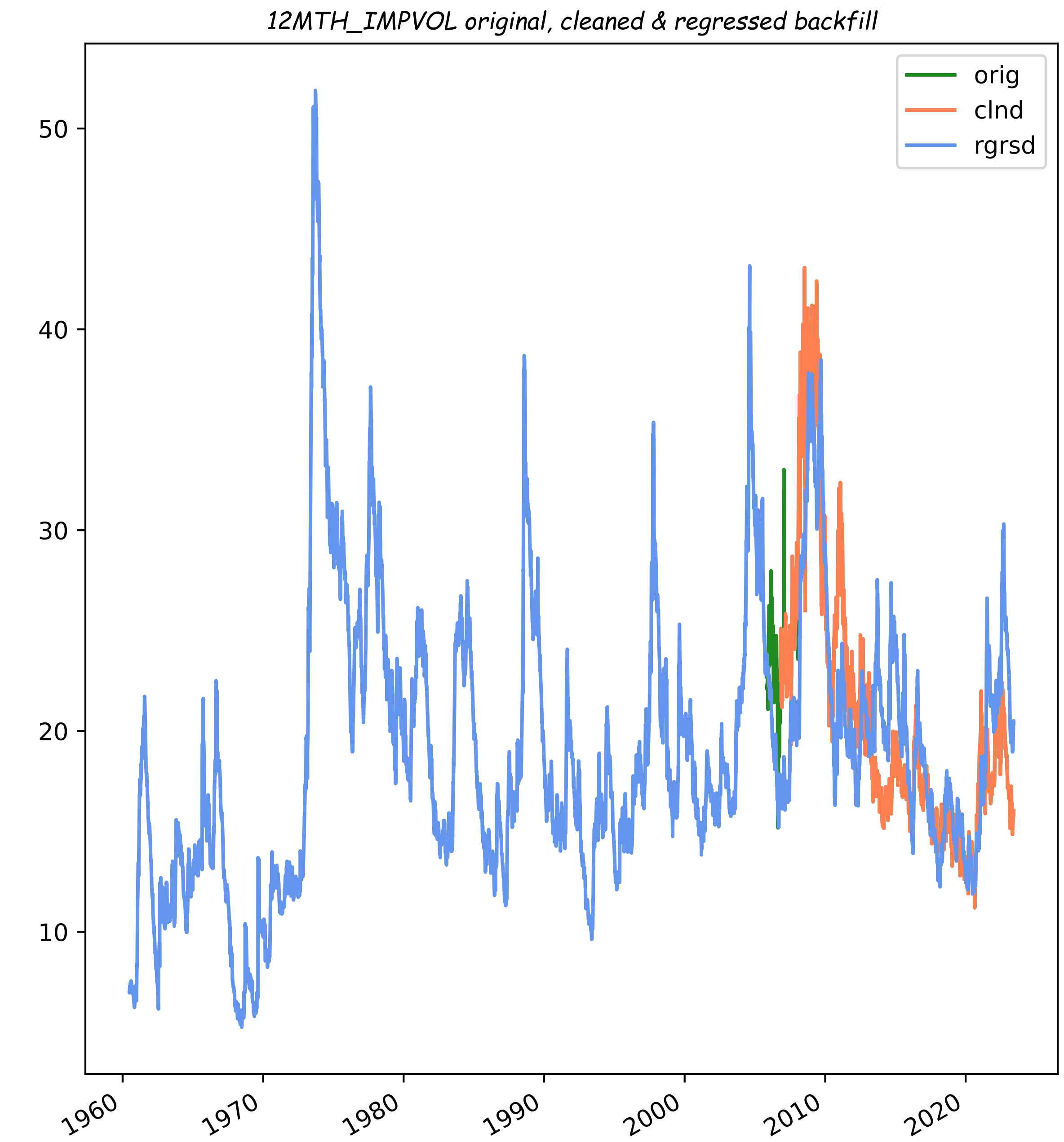
ADF Test of Resids.: -4.154 {5% -2.8624, 1% -3.4323	0

CO1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	06-23-1988	start	06-22-1989
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	3.662	total_return	0.402
cagr	0.045	cagr	0.010
max_drawdown	-0.863	max_drawdown	-0.799
calmar	0.052	calmar	0.013
mtd	-0.083	mtd	-0.032
three_month	-0.130	three_month	-0.062
six_month	-0.146	six_month	-0.150
ytd	-0.151	ytd	-0.170
one_year	-0.406	one_year	-0.242
three_year	0.240	three_year	-0.136
five_year	-0.012	five_year	0.058
ten_year	-0.031	ten_year	0.029
incep	0.045	incep	0.010
daily_sharpe	0.303	daily_sharpe	0.170
daily_sortino	0.486	daily_sortino	0.328
daily_mean	0.110	daily_mean	0.047
daily_vol	0.363	daily_vol	0.279
daily_skew	-0.182	daily_skew	3.950
daily_kurt	15.179	daily_kurt	70.670
best_day	0.327	best_day	0.389
worst_day	-0.319	worst_day	-0.195
monthly_sharpe	0.309	monthly_sharpe	0.192
monthly_sortino	0.540	monthly_sortino	0.488
monthly_mean	0.105	monthly_mean	0.073
monthly_vol	0.340	monthly_vol	0.380
monthly_skew	0.020	monthly_skew	2.648
monthly_kurt	4.477	monthly_kurt	14.958
best_month	0.462	best_month	0.932
worst_month	-0.550	worst_month	-0.241
yearly_sharpe	0.282	yearly_sharpe	0.205
yearly_sortino	0.686	yearly_sortino	0.711
yearly_mean	0.109	yearly_mean	0.096
yearly_vol	0.388	yearly_vol	0.468
yearly_skew	0.866	yearly_skew	2.104
yearly_kurt	1.970	yearly_kurt	6.380
best_year	1.382	best_year	1.941
worst_year	-0.514	worst_year	-0.470
avg_drawdown	-0.080	avg_drawdown	-0.121
avg_drawdown_days	171.671	avg_drawdown_days	725.941
avg_up_month	0.075	avg_up_month	0.092
avg_down_month	-0.069	avg_down_month	-0.054
win_year_perc	0.629	win_year_perc	0.441
twelve_month_win_perc	0.572	twelve_month_win_perc	0.509



S 1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:20.39 max:51.90 min:5.25 mean:19.15 lvl std (1y,all):2.4,7.3 %-ile:65.3 Z:0.17]
S 1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 11.9 26.4
-0.5 zscore 15.5
10
20
30
40
50
Jan 1960
Jan 1965
Jan 1970
Jan 1975
Jan 1980
Jan 1985
Jan 1990
Jan 1995
Jan 2000
Jan 2005
Jan 2010
Jan 2015
Jan 2020
Prospective 3sigma (std.lnr) [-3s: 7.70, +3s: 54.02, return std (ln).: 32.5, min(ts.min(252)/ts.max(252)-1): -0.77]





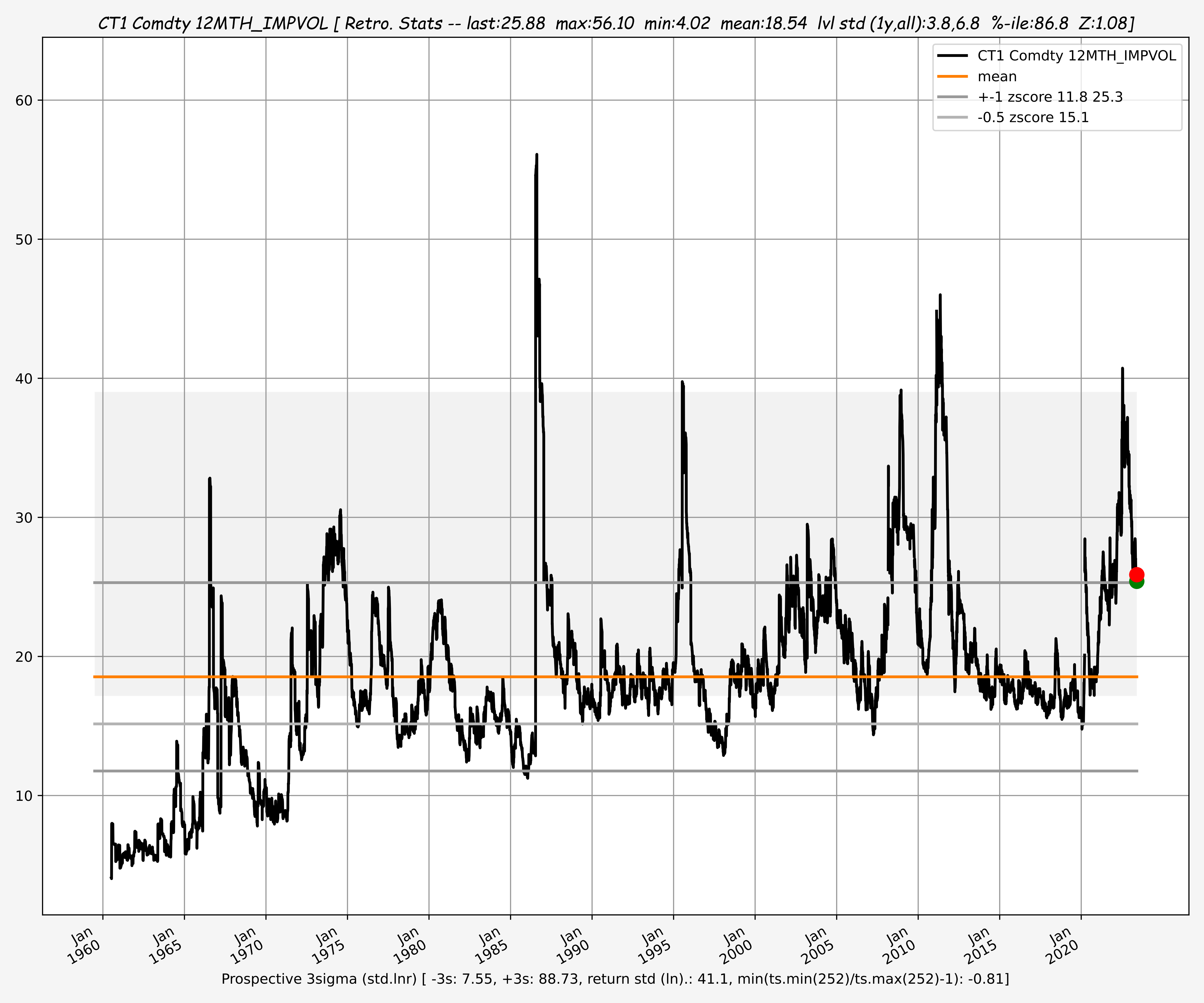
	S 1 Comdty
count	16073.000
mean	686.186
std	341.328
min	204.500
25%	479.000
50%	614.750
75%	870.500
max	1771.000

	12MTH_IMPVOL
count	15853.000
mean	19.121
std	7.012
min	5.251
25%	14.587
50%	18.035
75%	22.509
max	51.898

```
                                 OLS Regression Results
=======================================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.962
Model:                            OLS   Adj. R-squared (uncentered):              0.962
Method:                 Least Squares   F-statistic:                          2.135e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:16   Log-Likelihood:                         -11906.
No. Observations:                4166   AIC:                                  2.382e+04
Df Residuals:                    4161   BIC:                                  2.385e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0008      0.000      4.459      0.000       0.000       0.001
x2             0.1339      0.013     10.679      0.000       0.109       0.158
x3             0.1429      0.016      8.926      0.000       0.112       0.174
x4             0.1113      0.012      9.111      0.000       0.087       0.135
x5             0.4606      0.018     25.288      0.000       0.425       0.496
==============================================================================
Omnibus:                       79.695   Durbin-Watson:                   0.018
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               83.872
Skew:                           0.341   Prob(JB):                     6.13e-19
Kurtosis:                       3.135   Cond. No.                         377.
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

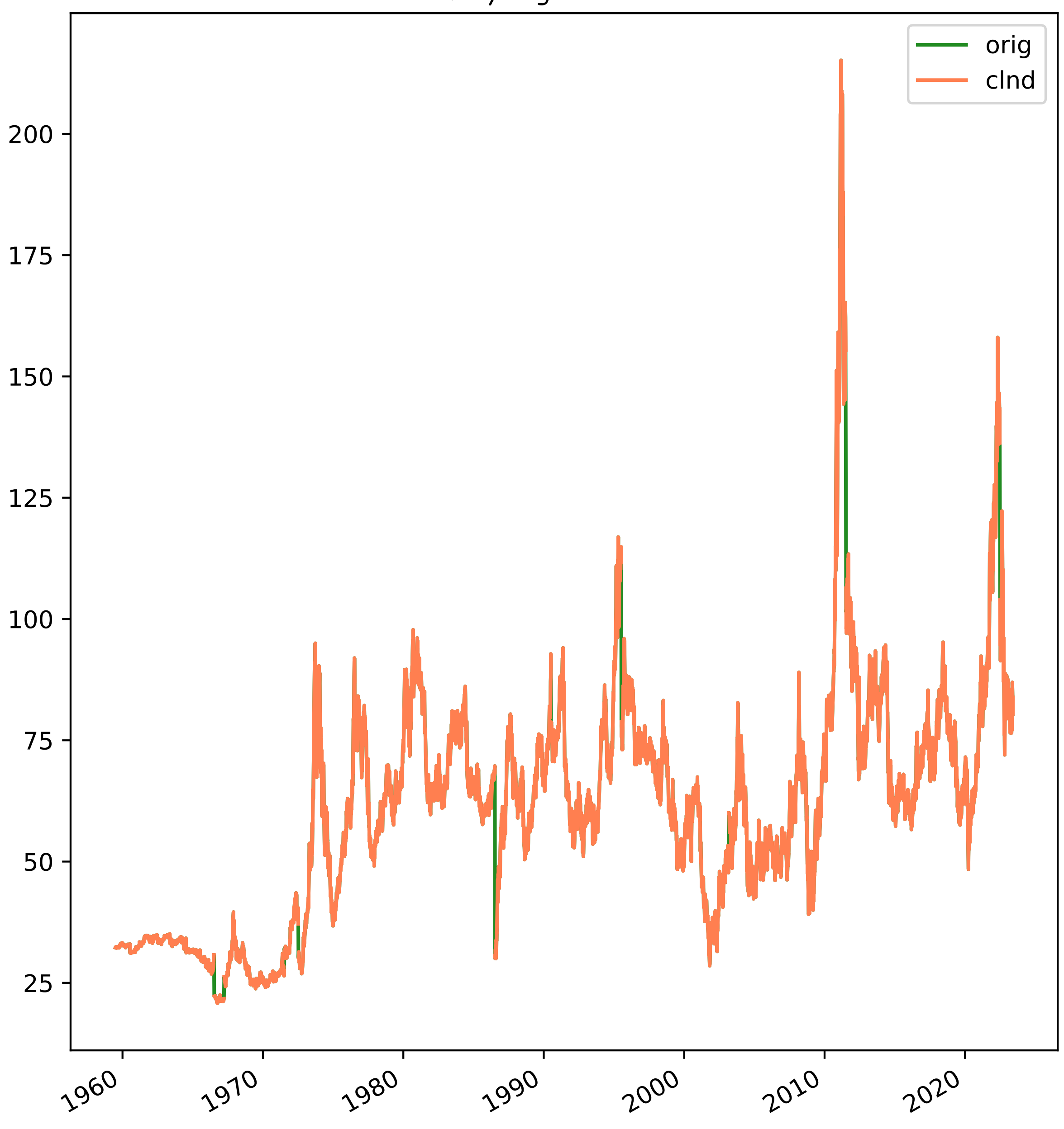
ADF Test of Resids.: -3.476 {5% -2.8622, 1% -3.4319	0

S 1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	07-01-1959	start	06-29-1960
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	5.113	total_return	1.925
cagr	0.029	cagr	0.017
max_drawdown	-0.661	max_drawdown	-0.814
calmar	0.043	calmar	0.021
mtd	-0.102	mtd	0.056
three_month	-0.130	three_month	-0.014
six_month	-0.118	six_month	-0.174
ytd	-0.146	ytd	-0.146
one_year	-0.230	one_year	-0.125
three_year	0.156	three_year	0.159
five_year	0.049	five_year	0.067
ten_year	-0.015	ten_year	-0.007
incep	0.029	incep	0.017
daily_sharpe	0.239	daily_sharpe	0.188
daily_sortino	0.372	daily_sortino	0.442
daily_mean	0.057	daily_mean	0.056
daily_vol	0.237	daily_vol	0.299
daily_skew	-0.572	daily_skew	15.335
daily_kurt	7.478	daily_kurt	665.261
best_day	0.106	best_day	1.031
worst_day	-0.180	worst_day	-0.187
monthly_sharpe	0.234	monthly_sharpe	0.209
monthly_sortino	0.422	monthly_sortino	0.537
monthly_mean	0.061	monthly_mean	0.078
monthly_vol	0.262	monthly_vol	0.373
monthly_skew	0.803	monthly_skew	2.475
monthly_kurt	7.304	monthly_kurt	13.969
best_month	0.577	best_month	1.014
worst_month	-0.329	worst_month	-0.242
yearly_sharpe	0.229	yearly_sharpe	0.199
yearly_sortino	0.549	yearly_sortino	0.524
yearly_mean	0.051	yearly_mean	0.075
yearly_vol	0.225	yearly_vol	0.378
yearly_skew	0.658	yearly_skew	1.226
yearly_kurt	0.458	yearly_kurt	2.612
best_year	0.754	best_year	1.536
worst_year	-0.357	worst_year	-0.612
avg_drawdown	-0.085	avg_drawdown	-0.068
avg_drawdown_days	481.917	avg_drawdown_days	485.723
avg_up_month	0.055	avg_up_month	0.094
avg_down_month	-0.048	avg_down_month	-0.056
win_year_perc	0.531	win_year_perc	0.540
twelve_month_win_perc	0.519	twelve_month_win_perc	0.521

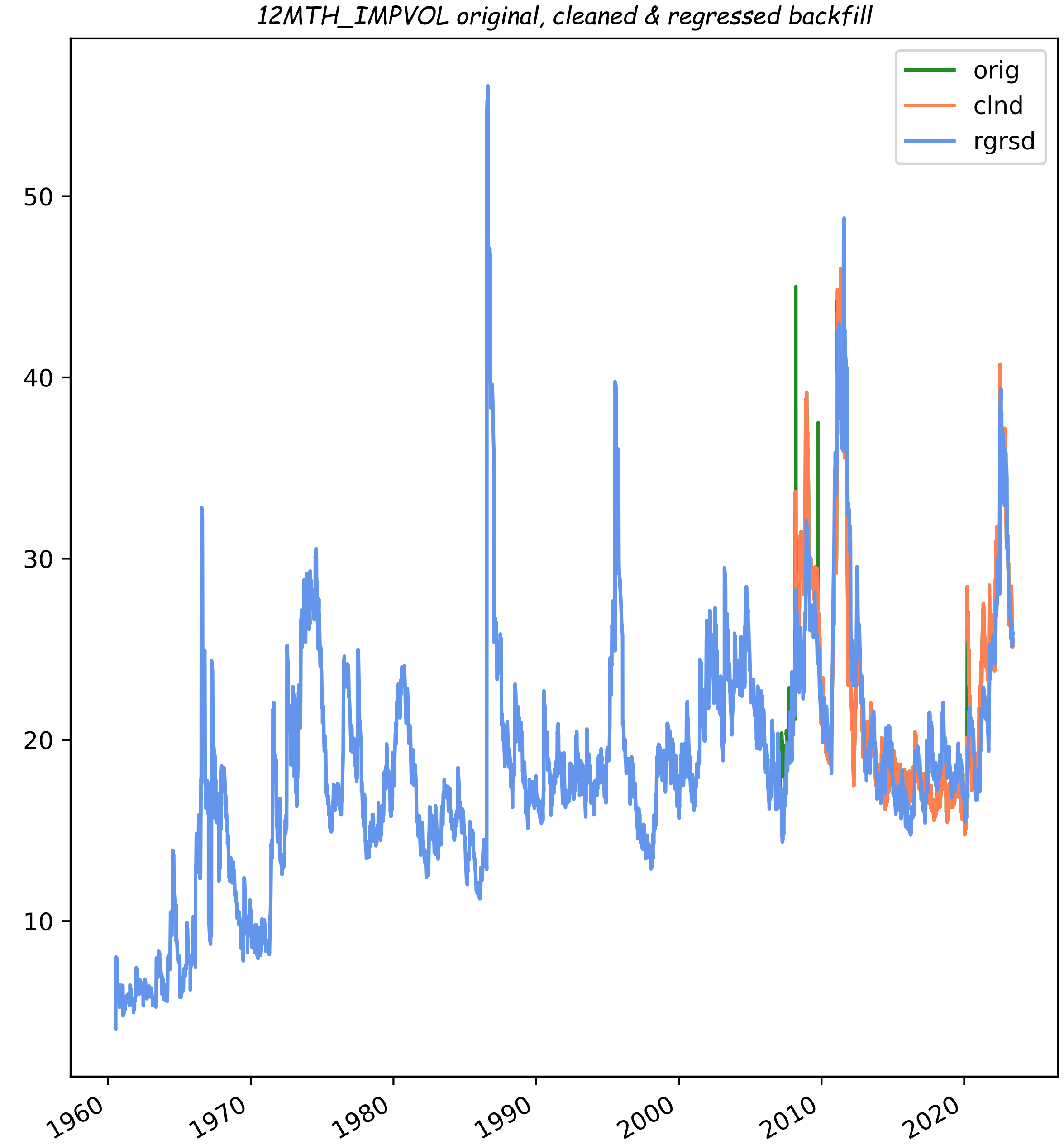


CT1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:25.88 max:56.10 min:4.02 mean:18.54 lvl std (1y,all):3.8,6.8 %-ile:86.8 Z:1.08]
CT1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 11.8 25.3
-0.5 zscore 15.1
60
50
40
30
20
10
Jan 1960
Jan 1965
Jan 1970
Jan 1975
Jan 1980
Jan 1985
Jan 1990
Jan 1995
Jan 2000
Jan 2005
Jan 2010
Jan 2015
Jan 2020
Prospective 3sigma (std.lnr) [-3s: 7.55, +3s: 88.73, return std (ln).: 41.1, min(ts.min(252)/ts.max(252)-1): -0.81]

CT1 Comdty original & cleaned data



12MTH_IMPVOL original, cleaned & regressed backfill



	CT1 Comdty
count	15997.000
mean	61.107
std	23.562
min	20.800
25%	44.300
50%	62.410
75%	74.320
max	215.150

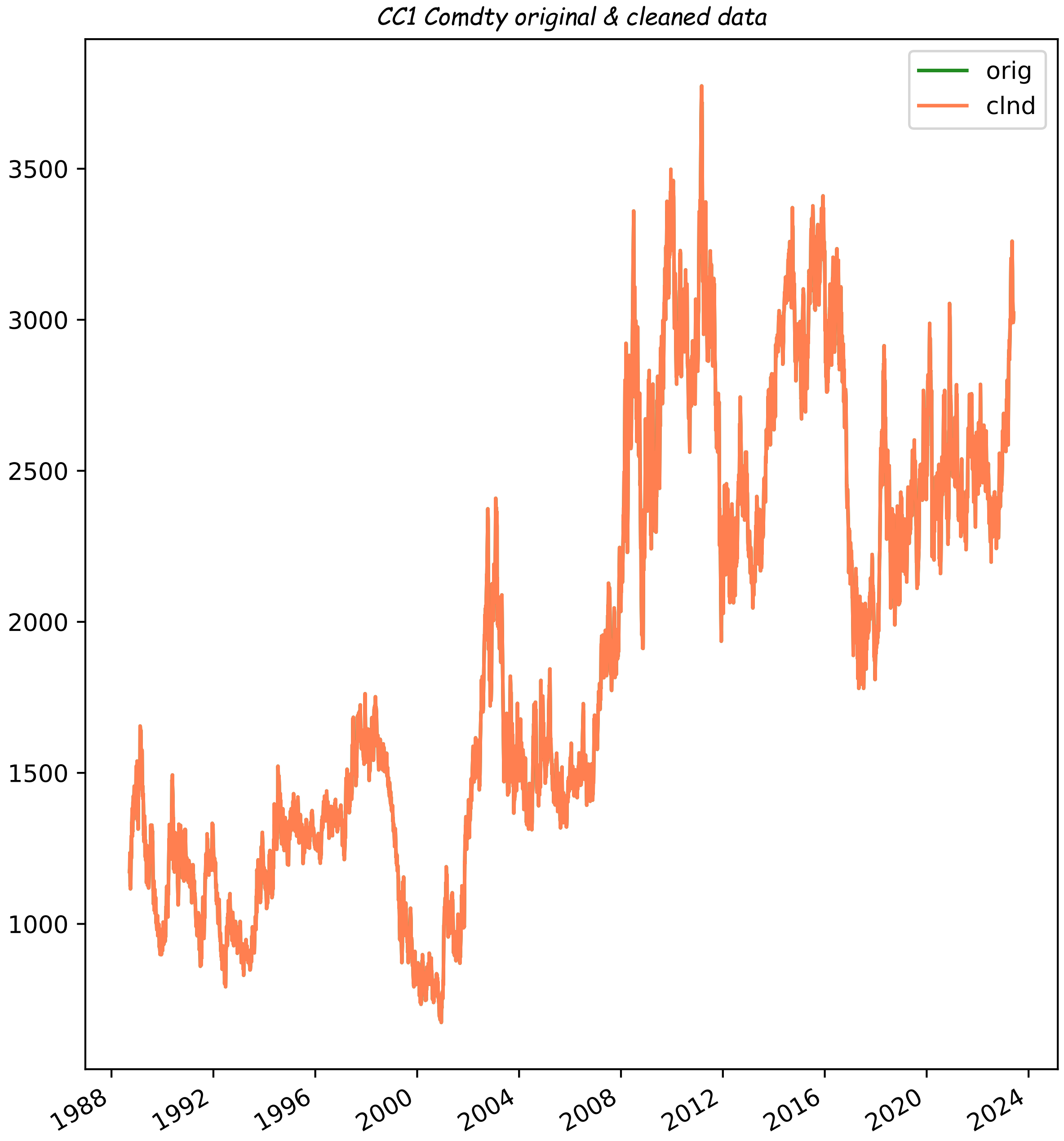
	12MTH_IMPVOL
count	15787.000
mean	18.518
std	6.721
min	4.023
25%	15.306
50%	18.133
75%	21.507
max	56.103

```
                                 OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.987
Model:                            OLS   Adj. R-squared (uncentered):              0.987
Method:                 Least Squares   F-statistic:                          5.720e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:23   Log-Likelihood:                         -9324.6
No. Observations:                3854   AIC:                                  1.866e+04
Df Residuals:                    3849   BIC:                                  1.869e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0786      0.001     53.821      0.000       0.076       0.081
x2             0.0799      0.005     14.712      0.000       0.069       0.091
x3             0.2646      0.007     35.311      0.000       0.250       0.279
x4             0.1363      0.006     21.585      0.000       0.124       0.149
x5             0.0886      0.009      9.772      0.000       0.071       0.106
==============================================================================
Omnibus:                      212.838   Durbin-Watson:                   0.047
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              843.869
Skew:                          -0.062   Prob(JB):                    5.70e-184
Kurtosis:                       5.289   Cond. No.                         25.5
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

	0
ADF Test of Resids.: -5.177 {5% -2.8623, 1% -3.4321	0

CT1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	07-01-1959	start	07-07-1960
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	1.591	total_return	5.348
cagr	0.015	cagr	0.030
max_drawdown	-0.775	max_drawdown	-0.770
calmar	0.019	calmar	0.039
mtd	0.058	mtd	0.016
three_month	-0.007	three_month	-0.059
six_month	-0.029	six_month	-0.278
ytd	0.003	ytd	-0.163
one_year	-0.399	one_year	-0.125
three_year	0.117	three_year	0.067
five_year	-0.021	five_year	0.054
ten_year	0.005	ten_year	0.036
incep	0.015	incep	0.030
daily_sharpe	0.198	daily_sharpe	0.219
daily_sortino	0.297	daily_sortino	0.735
daily_mean	0.053	daily_mean	0.129
daily_vol	0.269	daily_vol	0.590
daily_skew	-3.166	daily_skew	50.845
daily_kurt	97.336	daily_kurt	4015.952
best_day	0.207	best_day	3.250
worst_day	-0.554	worst_day	-0.382
monthly_sharpe	0.198	monthly_sharpe	0.207
monthly_sortino	0.322	monthly_sortino	0.706
monthly_mean	0.055	monthly_mean	0.123
monthly_vol	0.275	monthly_vol	0.595
monthly_skew	-0.392	monthly_skew	10.304
monthly_kurt	4.888	monthly_kurt	169.645
best_month	0.400	best_month	3.190
worst_month	-0.533	worst_month	-0.438
yearly_sharpe	0.180	yearly_sharpe	0.183
yearly_sortino	0.450	yearly_sortino	0.565
yearly_mean	0.059	yearly_mean	0.065
yearly_vol	0.329	yearly_vol	0.357
yearly_skew	1.556	yearly_skew	3.173
yearly_kurt	5.022	yearly_kurt	16.657
best_year	1.493	best_year	2.109
worst_year	-0.584	worst_year	-0.451
avg_drawdown	-0.095	avg_drawdown	-0.136
avg_drawdown_days	378.918	avg_drawdown_days	916.160
avg_up_month	0.056	avg_up_month	0.099
avg_down_month	-0.055	avg_down_month	-0.060
win_year_perc	0.516	win_year_perc	0.524
twelve_month_win_perc	0.505	twelve_month_win_perc	0.493


CC1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:22.72 max:30.43 min:12.54 mean:20.51 lvl std (1y,all):0.6,3.4 %-ile:74.2 Z:0.64]
CC1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 17.1 23.9
-0.5 zscore 18.8
30
25
20
15
Jan 1989
Jan 1994
Jan 1999
Jan 2004
Jan 2009
Jan 2014
Jan 2019
Prospective 3sigma (std.lnr) [-3s: 14.49, +3s: 35.63, return std (ln).: 15.0, min(ts.min(252)/ts.max(252)-1): -0.35]



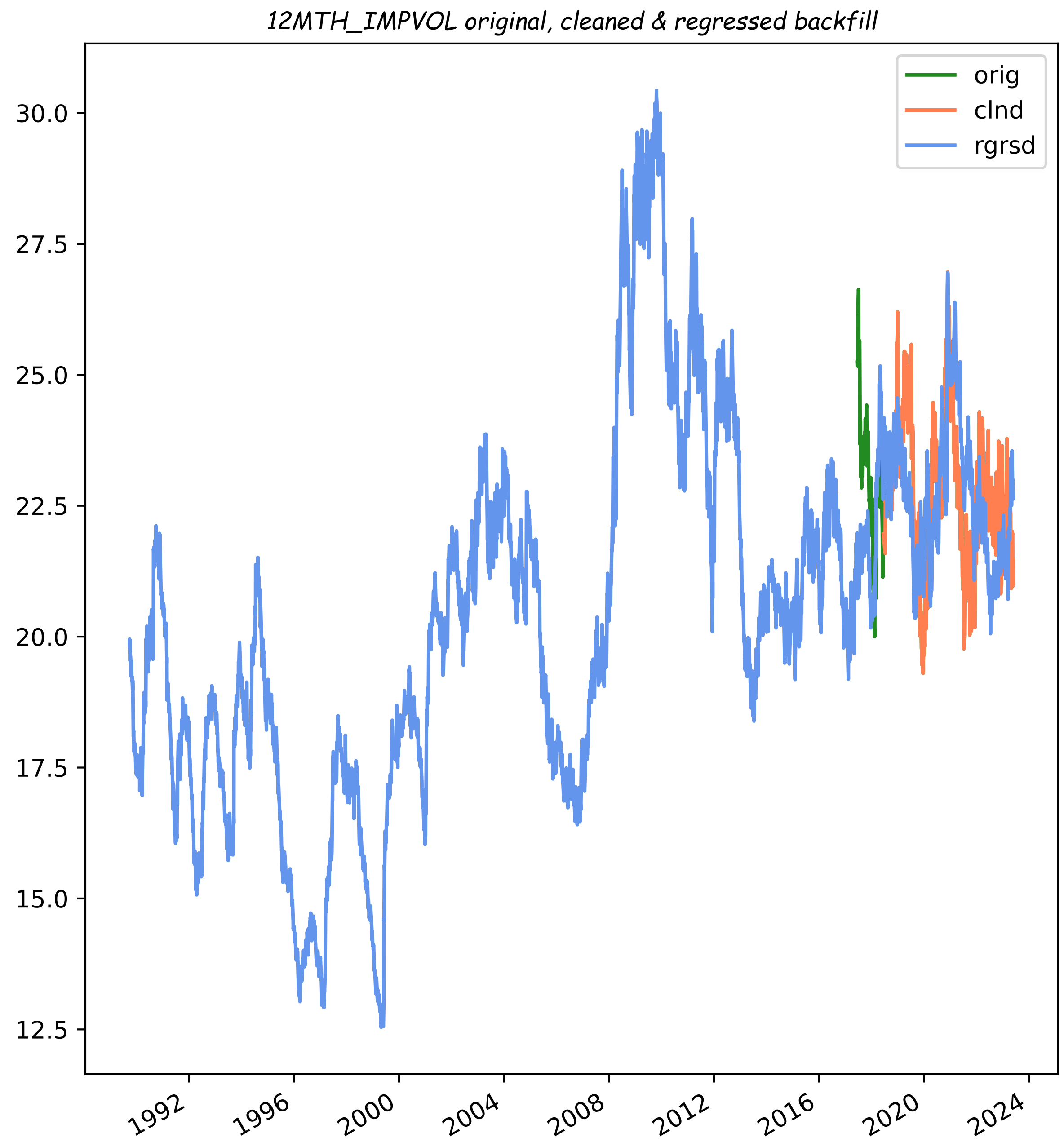
	CC1 Comdty
count	8698.000
mean	1899.107
std	727.137
min	674.000
25%	1298.000
50%	1727.000
75%	2500.000
max	3774.000

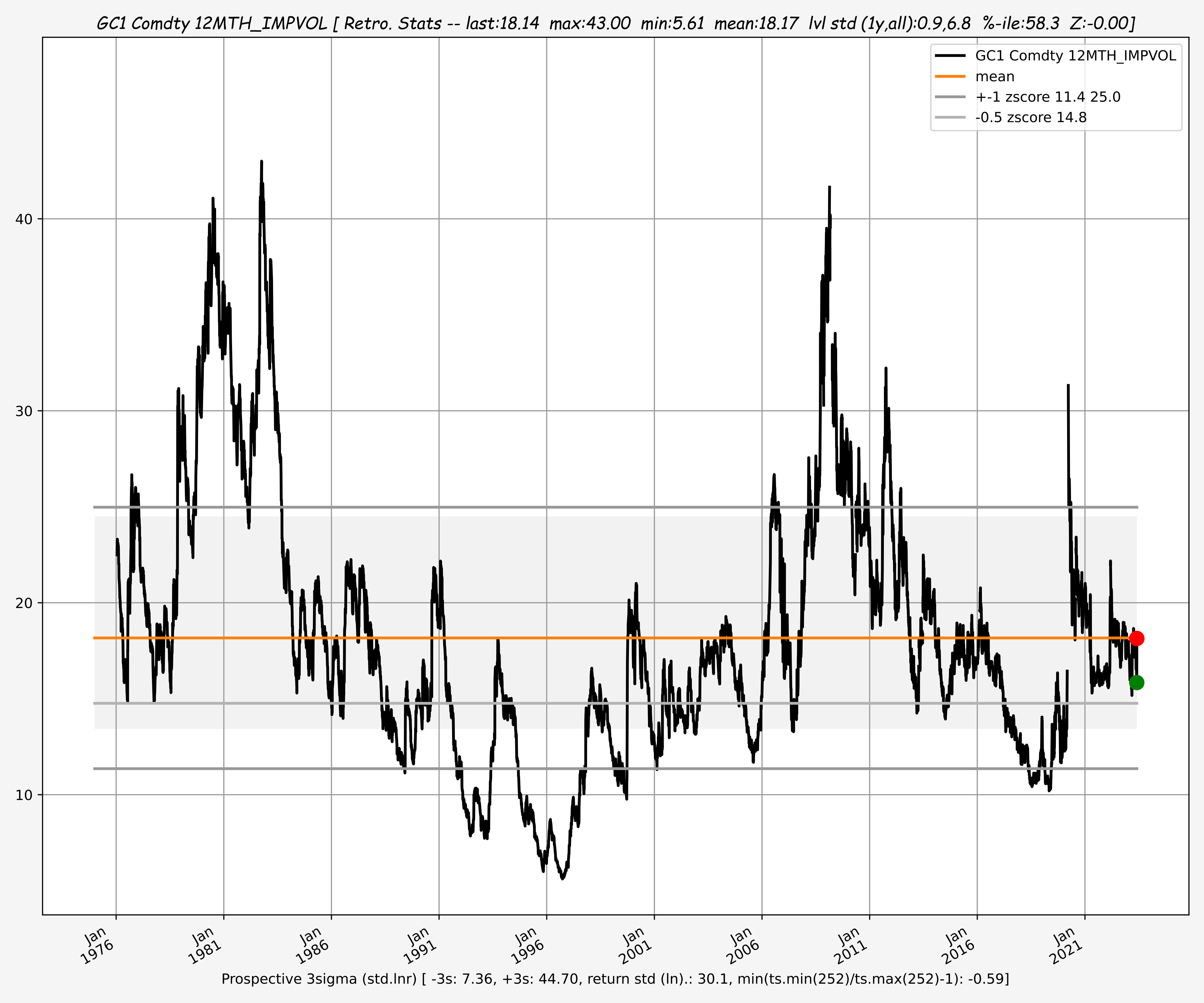
	12MTH_IMPVOL
count	8446.000
mean	20.501
std	3.422
min	12.541
25%	18.057
50%	20.639
75%	22.524
max	30.431

```
                                 OLS Regression Results
=======================================================================================================
Dep. Variable:                      y   R-squared (uncentered):                          0.996
Model:                            OLS   Adj. R-squared (uncentered):                     0.996
Method:                 Least Squares   F-statistic:                                 6.313e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                               0.00
Time:                        10:55:28   Log-Likelihood:                                -2212.4
No. Observations:                1247   AIC:                                             4435.
Df Residuals:                    1242   BIC:                                             4461.
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0045      0.000     43.662      0.000       0.004       0.005
x2            -0.0197      0.009     -2.095      0.036      -0.038      -0.001
x3             0.0996      0.014      7.080      0.000       0.072       0.127
x4             0.0793      0.014      5.706      0.000       0.052       0.107
x5             0.2433      0.019     12.535      0.000       0.205       0.281
==============================================================================
Omnibus:                      312.705   Durbin-Watson:                   0.047
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               67.626
Skew:                          -0.256   Prob(JB):                     2.07e-15
Kurtosis:                       1.980   Cond. No.                     1.40e+03
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[3] The condition number is large, 1.4e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

ADF Test of Resids.:-3.547 {5% -2.8639, 1% -3.4356 | 0 | 0

CC1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	09-16-1988	start	09-25-1989
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	1.576	total_return	0.148
cagr	0.028	cagr	0.004
max_drawdown	-0.617	max_drawdown	-0.433
calmar	0.045	calmar	0.009
mtd	-0.048	mtd	-0.015
three_month	0.100	three_month	0.050
six_month	0.233	six_month	0.062
ytd	0.162	ytd	0.039
one_year	0.211	one_year	0.046
three_year	0.066	three_year	0.001
five_year	0.043	five_year	-0.006
ten_year	0.033	ten_year	0.020
incep	0.028	incep	0.004
daily_sharpe	0.242	daily_sharpe	0.098
daily_sortino	0.415	daily_sortino	0.199
daily_mean	0.074	daily_mean	0.013
daily_vol	0.304	daily_vol	0.137
daily_skew	0.187	daily_skew	1.673
daily_kurt	2.605	daily_kurt	12.595
best_day	0.136	best_day	0.112
worst_day	-0.095	worst_day	-0.040
monthly_sharpe	0.242	monthly_sharpe	0.101
monthly_sortino	0.460	monthly_sortino	0.212
monthly_mean	0.073	monthly_mean	0.016
monthly_vol	0.302	monthly_vol	0.154
monthly_skew	0.403	monthly_skew	1.163
monthly_kurt	0.984	monthly_kurt	3.886
best_month	0.346	best_month	0.269
worst_month	-0.281	worst_month	-0.101
yearly_sharpe	0.198	yearly_sharpe	0.121
yearly_sortino	0.389	yearly_sortino	0.268
yearly_mean	0.048	yearly_mean	0.019
yearly_vol	0.242	yearly_vol	0.156
yearly_skew	0.359	yearly_skew	0.805
yearly_kurt	0.970	yearly_kurt	0.445
best_year	0.728	best_year	0.429
worst_year	-0.393	worst_year	-0.234
avg_drawdown	-0.106	avg_drawdown	-0.060
avg_drawdown_days	284.955	avg_drawdown_days	321.395
avg_up_month	0.071	avg_up_month	0.038
avg_down_month	-0.063	avg_down_month	-0.029
win_year_perc	0.629	win_year_perc	0.500
twelve_month_win_perc	0.552	twelve_month_win_perc	0.500

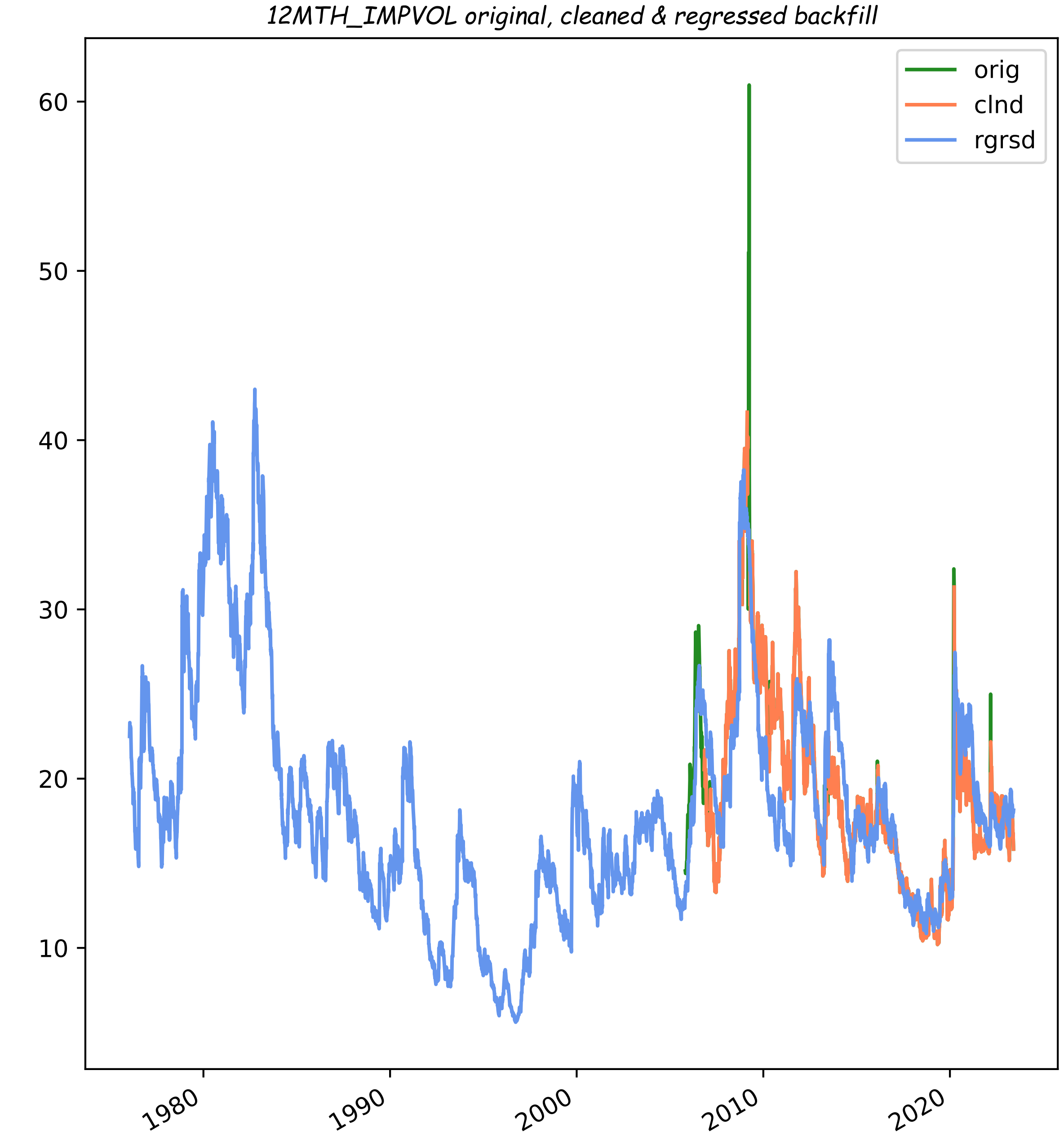




GC1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:18.14 max:43.00 min:5.61 mean:18.17 lvl std (1y,all):0.9,6.8 %-ile:58.3 Z:-0.00]
GC1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 11.4 25.0
-0.5 zscore 14.8
10
20
30
40
Jan 1976
Jan 1981
Jan 1986
Jan 1991
Jan 1996
Jan 2001
Jan 2006
Jan 2011
Jan 2016
Jan 2021
Prospective 3sigma (std.lnr) [-3s: 7.36, +3s: 44.70, return std (ln).: 30.1, min(ts.min(252)/ts.max(252)-1): -0.59]

GC1 Comdty original & cleaned data

12MTH_IMPVOL original, cleaned & regressed backfill

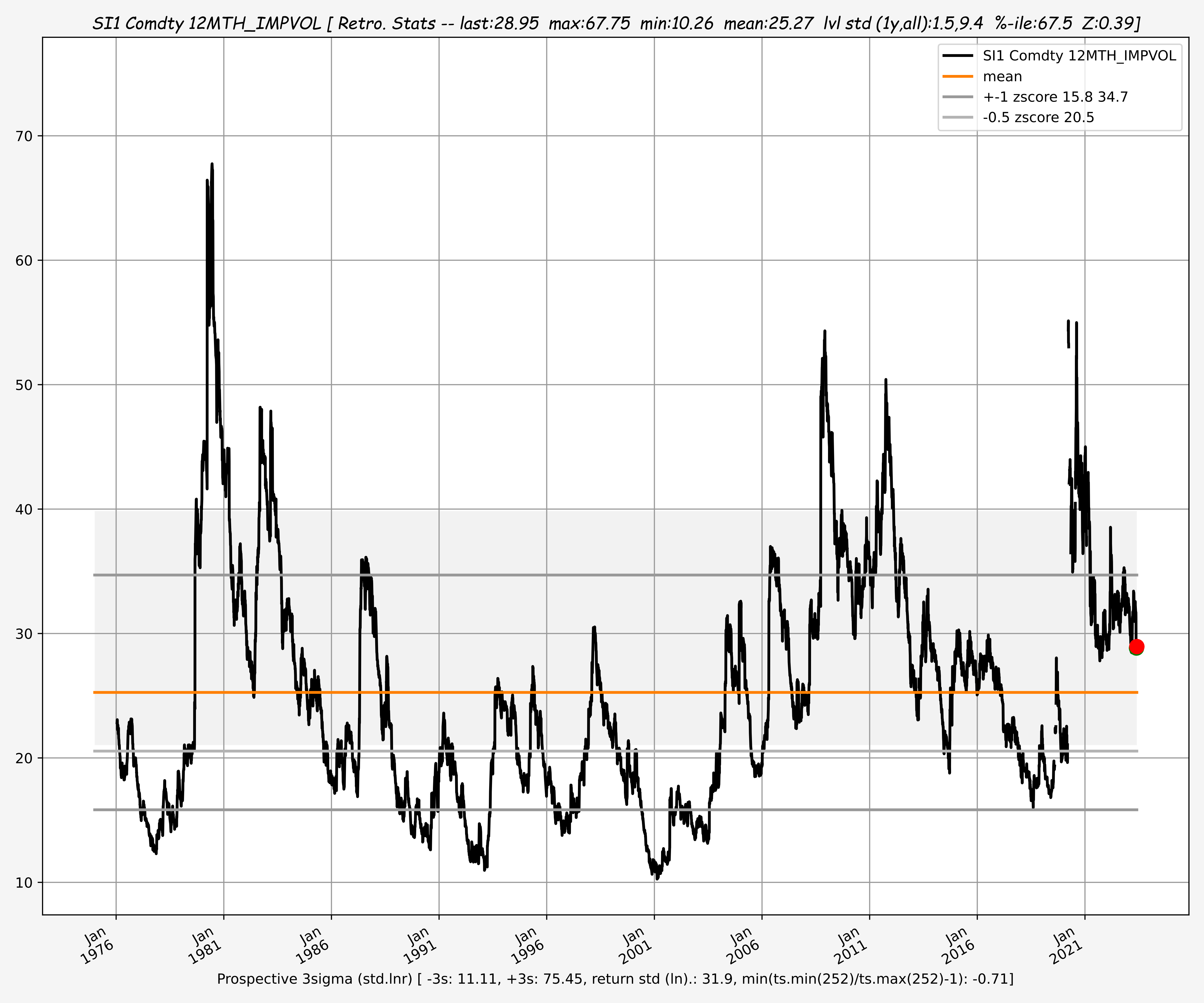


	GC1 Comdty
count	12024.000
mean	695.606
std	521.676
min	102.400
25%	337.200
50%	407.450
75%	1192.450
max	2055.700

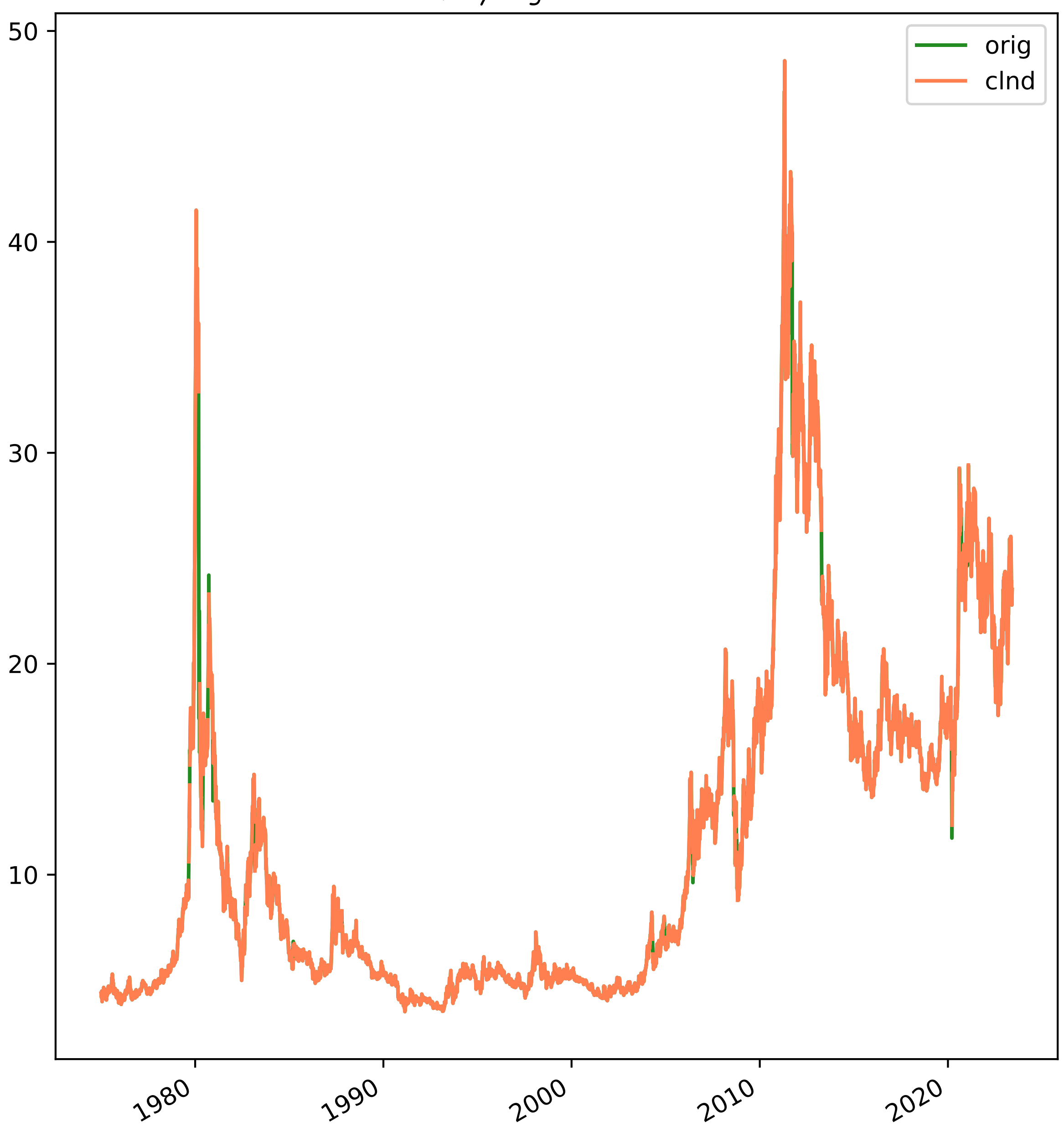
	12MTH_IMPVOL
count	11858.000
mean	18.191
std	6.689
min	5.610
25%	14.003
50%	17.192
75%	21.163
max	43.004

```
                                OLS Regression Results
=======================================================================================================
Dep. Variable:                      y   R-squared (uncentered):                       0.978
Model:                            OLS   Adj. R-squared (uncentered):                  0.978
Method:                 Least Squares   F-statistic:                              3.726e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                            0.00
Time:                        10:55:33   Log-Likelihood:                             -10425.
No. Observations:                4169   AIC:                                      2.086e+04
Df Residuals:                    4164   BIC:                                      2.089e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0013   8.04e-05     15.599      0.000       0.001       0.001
x2             0.1419      0.012     11.852      0.000       0.118       0.165
x3             0.2787      0.016     17.325      0.000       0.247       0.310
x4             0.0669      0.013      5.271      0.000       0.042       0.092
x5             0.5377      0.016     32.975      0.000       0.506       0.570
==============================================================================
Omnibus:                      174.701   Durbin-Watson:                   0.032
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              197.480
Skew:                           0.508   Prob(JB):                     1.31e-43
Kurtosis:                       3.326   Cond. No.                         619.
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

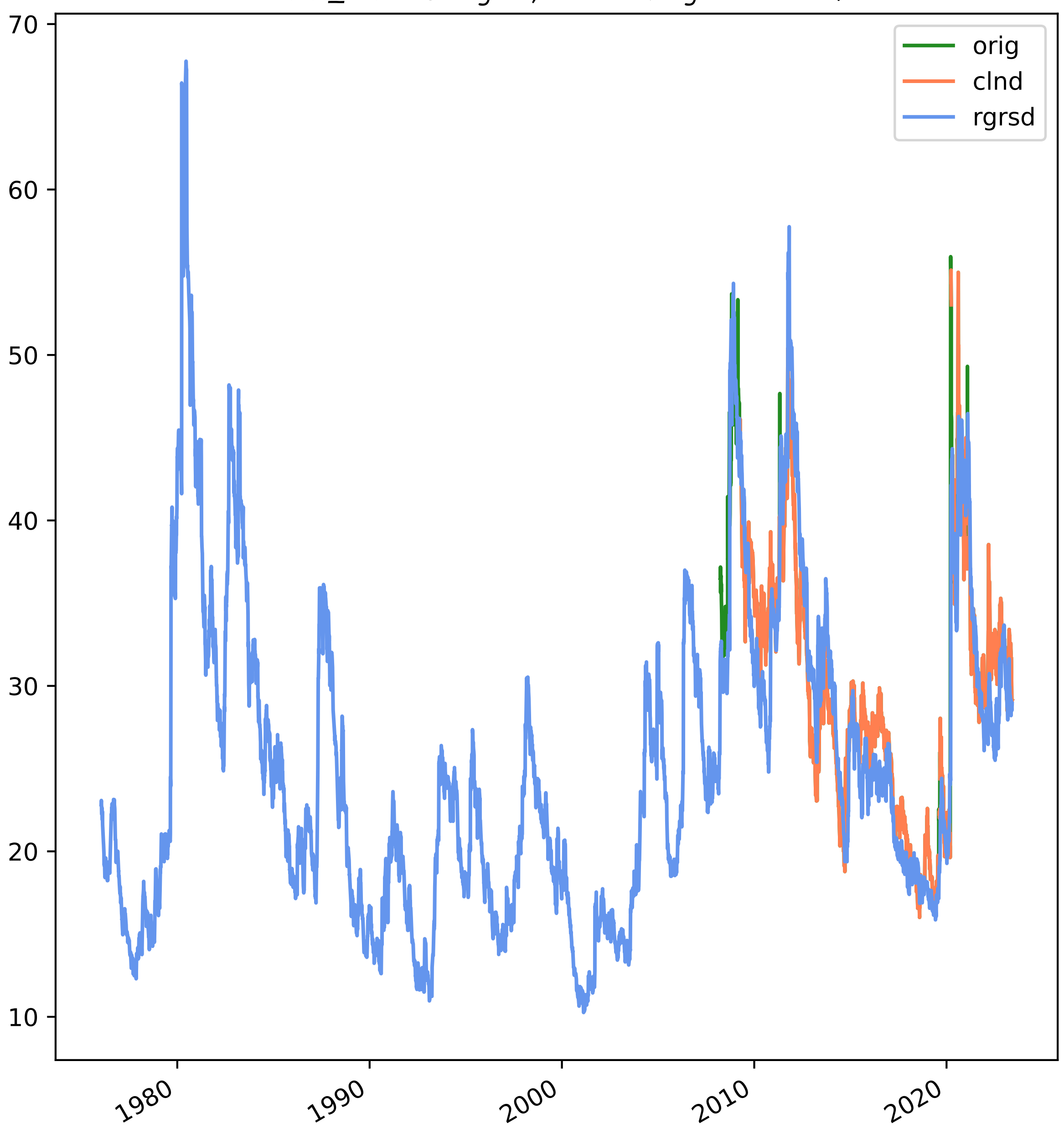
ADF Test of Resids.: -3.374 {5% -2.8622, 1% -3.4319	0		0
GC1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	01-02-1975	start	01-16-1976
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	10.267	total_return	-0.194
cagr	0.051	cagr	-0.005
max_drawdown	-0.646	max_drawdown	-0.870
calmar	0.079	calmar	-0.005
mtd	-0.013	mtd	-0.014
three_month	0.074	three_month	0.048
six_month	0.130	six_month	0.020
ytd	0.080	ytd	-0.042
one_year	0.071	one_year	0.009
three_year	0.043	three_year	-0.091
five_year	0.087	five_year	0.079
ten_year	0.035	ten_year	-0.014
incep	0.051	incep	-0.005
daily_sharpe	0.368	daily_sharpe	0.111
daily_sortino	0.598	daily_sortino	0.267
daily_mean	0.068	daily_mean	0.030
daily_vol	0.184	daily_vol	0.272
daily_skew	0.089	daily_skew	6.677
daily_kurt	8.029	daily_kurt	106.367
best_day	0.140	best_day	0.400
worst_day	-0.115	worst_day	-0.105
monthly_sharpe	0.361	monthly_sharpe	0.141
monthly_sortino	0.684	monthly_sortino	0.371
monthly_mean	0.067	monthly_mean	0.049
monthly_vol	0.186	monthly_vol	0.347
monthly_skew	0.506	monthly_skew	2.025
monthly_kurt	4.010	monthly_kurt	6.613
best_month	0.291	best_month	0.626
worst_month	-0.217	worst_month	-0.163
yearly_sharpe	0.318	yearly_sharpe	0.136
yearly_sortino	1.010	yearly_sortino	0.361
yearly_mean	0.078	yearly_mean	0.051
yearly_vol	0.246	yearly_vol	0.378
yearly_skew	2.961	yearly_skew	1.234
yearly_kurt	15.335	yearly_kurt	1.718
best_year	1.362	best_year	1.342
worst_year	-0.328	worst_year	-0.412
avg_drawdown	-0.051	avg_drawdown	-0.110
avg_drawdown_days	180.333	avg_drawdown_days	662.577
avg_up_month	0.044	avg_up_month	0.091
avg_down_month	-0.034	avg_down_month	-0.056
win_year_perc	0.583	win_year_perc	0.489
twelve_month_win_perc	0.581	twelve_month_win_perc	0.459


SI1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:28.95 max:67.75 min:10.26 mean:25.27 lvl std (1y,all):1.5,9.4 %-ile:67.5 Z:0.39]
SI1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 15.8 34.7
-0.5 zscore 20.5
70
60
50
40
30
20
10
Jan 1976
Jan 1981
Jan 1986
Jan 1991
Jan 1996
Jan 2001
Jan 2006
Jan 2011
Jan 2016
Jan 2021
Prospective 3sigma (std.lnr) [-3s: 11.11, +3s: 75.45, return std (ln).: 31.9, min(ts.min(252)/ts.max(252)-1): -0.71]

SI1 Comdty original & cleaned data



12MTH_IMPVOL original, cleaned & regressed backfill



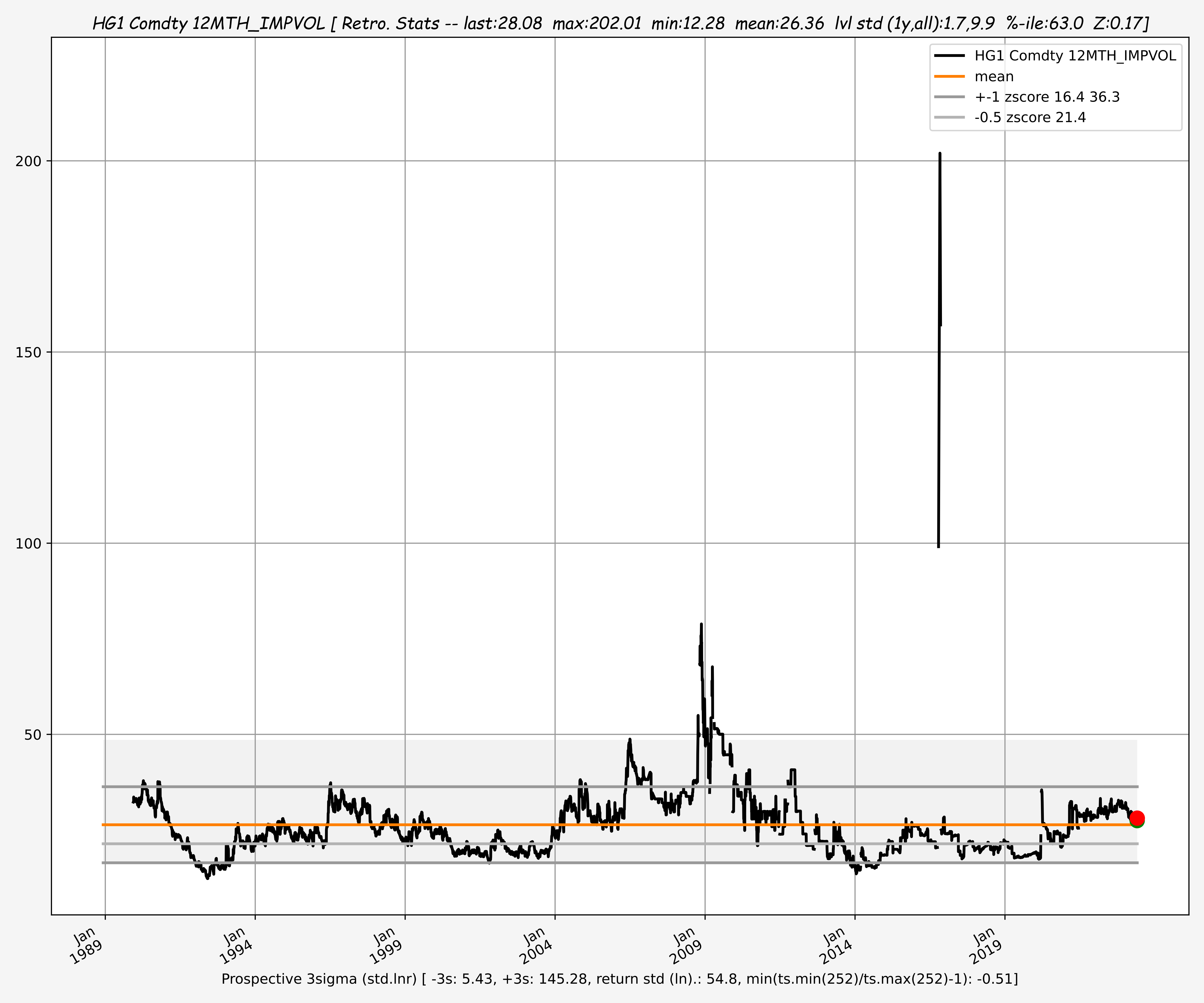
	SI1 Comdty
count	12035.000
mean	11.226
std	8.061
min	3.510
25%	5.053
50%	7.106
75%	16.422
max	48.584

	12MTH_IMPVOL
count	11877.000
mean	25.143
std	9.609
min	10.261
25%	17.991
50%	23.326
75%	30.591
max	67.755

```
                                OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.988
Model:                            OLS   Adj. R-squared (uncentered):              0.988
Method:                 Least Squares   F-statistic:                          5.817e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:37   Log-Likelihood:                         -9385.5
No. Observations:                3564   AIC:                                  1.878e+04
Df Residuals:                    3559   BIC:                                  1.881e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.2928      0.009     34.028      0.000       0.276       0.310
x2             0.1194      0.007     16.572      0.000       0.105       0.134
x3             0.2491      0.010     24.192      0.000       0.229       0.269
x4             0.0804      0.009      9.080      0.000       0.063       0.098
x5             0.3174      0.012     27.518      0.000       0.295       0.340
==============================================================================
Omnibus:                      163.557   Durbin-Watson:                   0.071
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              310.836
Skew:                          -0.341   Prob(JB):                     3.18e-68
Kurtosis:                       4.276   Cond. No.                         17.3
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

	0
ADF Test of Resids.: -4.220 (5% -2.8624, 1% -3.4322	0

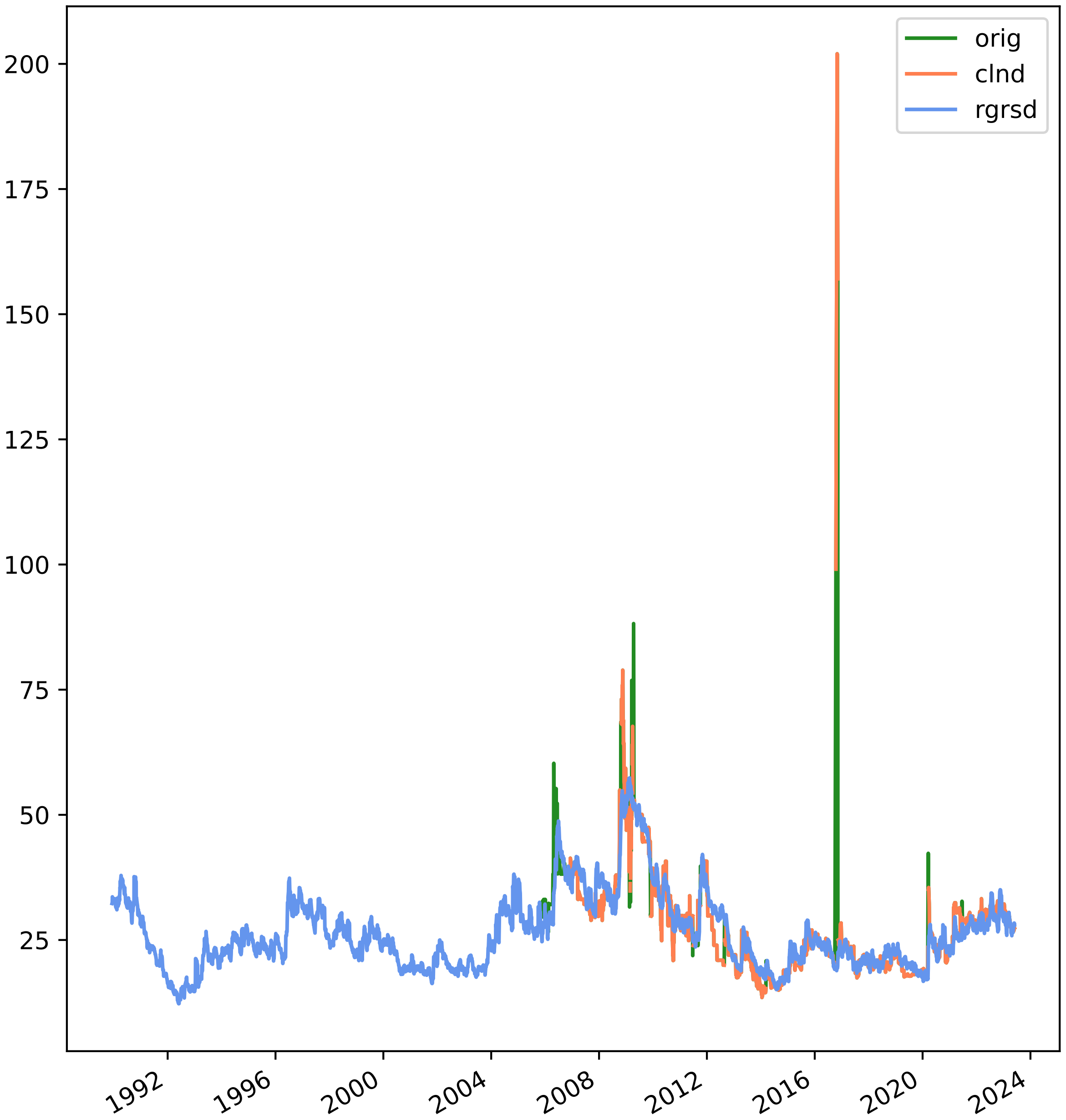
SI1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	01-02-1975	start	01-16-1976
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	4.372	total_return	0.268
cagr	0.035	cagr	0.005
max_drawdown	-0.915	max_drawdown	-0.849
calmar	0.039	calmar	0.006
mtd	-0.059	mtd	-0.008
three_month	0.122	three_month	0.001
six_month	0.091	six_month	-0.086
ytd	-0.022	ytd	-0.138
one_year	0.084	one_year	0.065
three_year	0.077	three_year	-0.092
five_year	0.074	five_year	0.095
ten_year	0.006	ten_year	0.001
incep	0.035	incep	0.005
daily_sharpe	0.271	daily_sharpe	0.155
daily_sortino	0.425	daily_sortino	0.388
daily_mean	0.084	daily_mean	0.048
daily_vol	0.311	daily_vol	0.309
daily_skew	-0.661	daily_skew	10.278
daily_kurt	25.131	daily_kurt	248.025
best_day	0.254	best_day	0.596
worst_day	-0.386	worst_day	-0.151
monthly_sharpe	0.270	monthly_sharpe	0.175
monthly_sortino	0.516	monthly_sortino	0.460
monthly_mean	0.088	monthly_mean	0.064
monthly_vol	0.326	monthly_vol	0.368
monthly_skew	0.748	monthly_skew	2.333
monthly_kurt	5.763	monthly_kurt	9.587
best_month	0.583	best_month	0.712
worst_month	-0.460	worst_month	-0.208
yearly_sharpe	0.188	yearly_sharpe	0.184
yearly_sortino	0.931	yearly_sortino	0.597
yearly_mean	0.111	yearly_mean	0.082
yearly_vol	0.591	yearly_vol	0.443
yearly_skew	5.082	yearly_skew	1.532
yearly_kurt	31.029	yearly_kurt	2.410
best_year	3.734	best_year	1.637
worst_year	-0.486	worst_year	-0.410
avg_drawdown	-0.077	avg_drawdown	-0.152
avg_drawdown_days	379.913	avg_drawdown_days	1326.538
avg_up_month	0.074	avg_up_month	0.090
avg_down_month	-0.058	avg_down_month	-0.057
win_year_perc	0.500	win_year_perc	0.447
twelve_month_win_perc	0.475	twelve_month_win_perc	0.434



HG1 Comdty 12MTH_IMPVOL [Retro. Stats -- last:28.08 max:202.01 min:12.28 mean:26.36 lvl std (1y,all):1.7,9.9 %-ile:63.0 Z:0.17]
HG1 Comdty 12MTH_IMPVOL
mean
+-1 zscore 16.4 36.3
-0.5 zscore 21.4
200
150
100
50
Jan 1989
Jan 1994
Jan 1999
Jan 2004
Jan 2009
Jan 2014
Jan 2019
Prospective 3sigma (std.lnr) [-3s: 5.43, +3s: 145.28, return std (ln).: 54.8, min(ts.min(252)/ts.max(252)-1): -0.51]

HG1 Comdty original & cleaned data

12MTH_IMPVOL original, cleaned & regressed backfill



	HG1 Comdty
count	8637.000
mean	211.002
std	119.453
min	60.600
25%	99.890
50%	183.500
75%	316.600
max	492.900

	12MTH_IMPVOL
count	8415.000
mean	26.400
std	7.503
min	12.278
25%	21.100
50%	24.757
75%	30.197
max	57.377

OLS Regression Results

Dep. Variable:	y	R-squared (uncentered):	0.876
Model:	OLS	Adj. R-squared (uncentered):	0.876
Method:	Least Squares	F-statistic:	5894.
Date:	Wed, 31 May 2023	Prob (F-statistic):	0.00
Time:	10:55:40	Log-Likelihood:	-15902.
No. Observations:	4172	AIC:	3.181e+04
Df Residuals:	4167	BIC:	3.185e+04
Df Model:	5		
Covariance Type:	nonrobust		

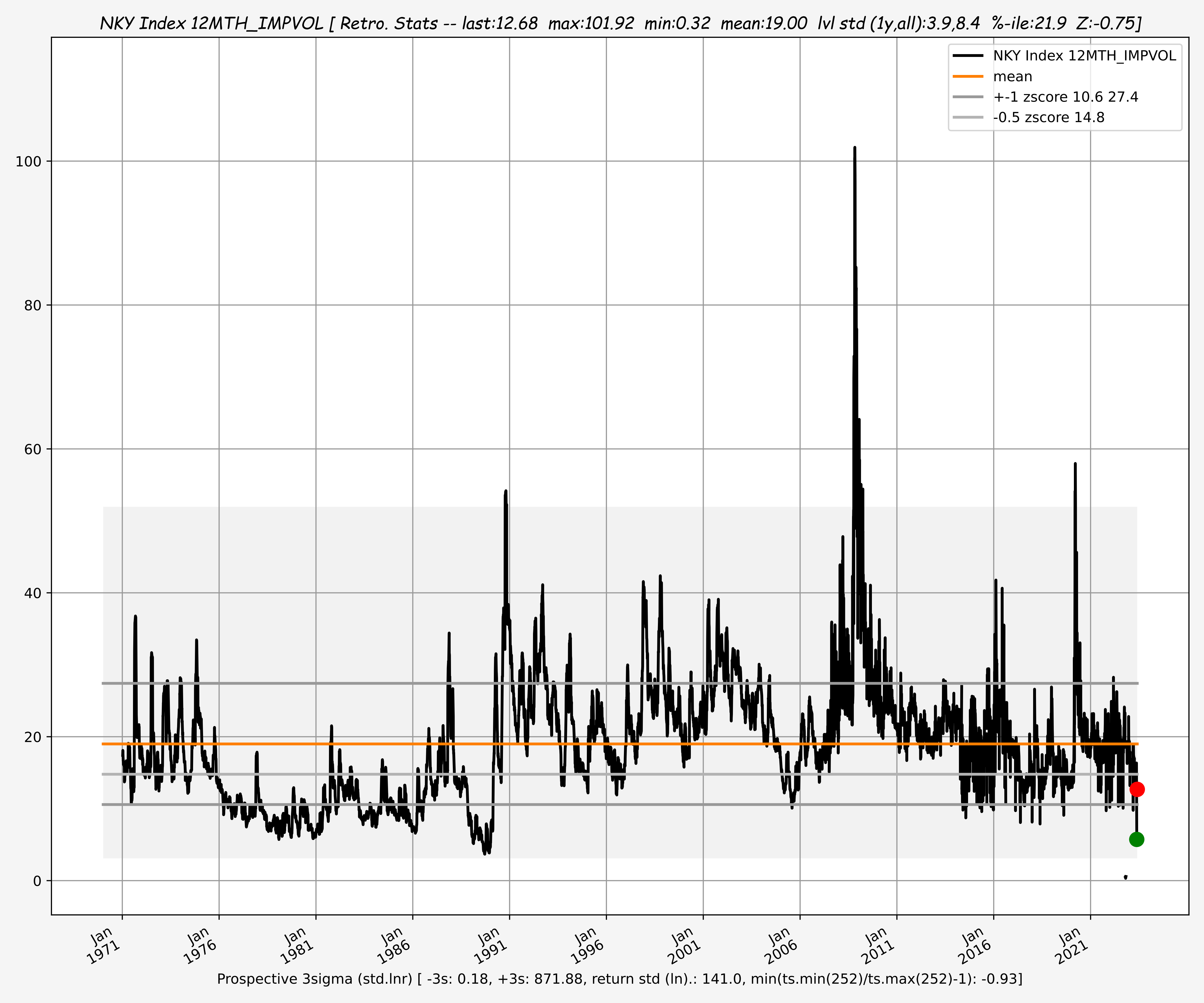
	coef	std err	t	P>|t|	[0.025	0.975]
x1	0.0032	0.001	2.285	0.022	0.000	0.006
x2	0.2391	0.034	7.026	0.000	0.172	0.306
x3	0.2179	0.048	4.553	0.000	0.124	0.312
x4	0.0042	0.038	0.112	0.911	-0.070	0.079
x5	0.5999	0.053	11.404	0.000	0.497	0.703

Omnibus:	7154.071	Durbin-Watson:	0.055
Prob(Omnibus):	0.000	Jarque-Bera (JB):	4730694.148
Skew:	12.013	Prob(JB):	0.00
Kurtosis:	166.208	Cond. No.	126.

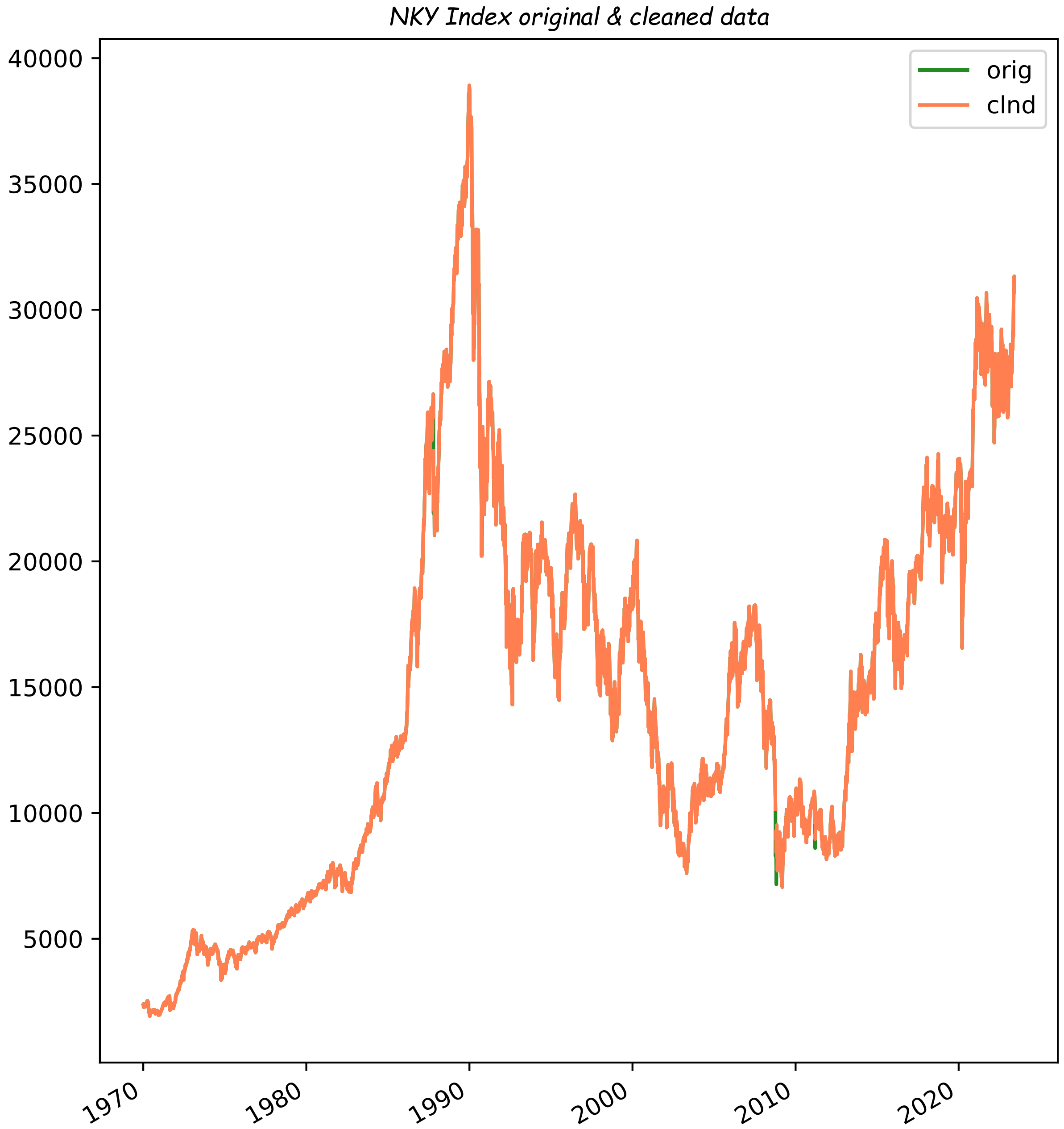
Notes:
[1] R^2 is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.

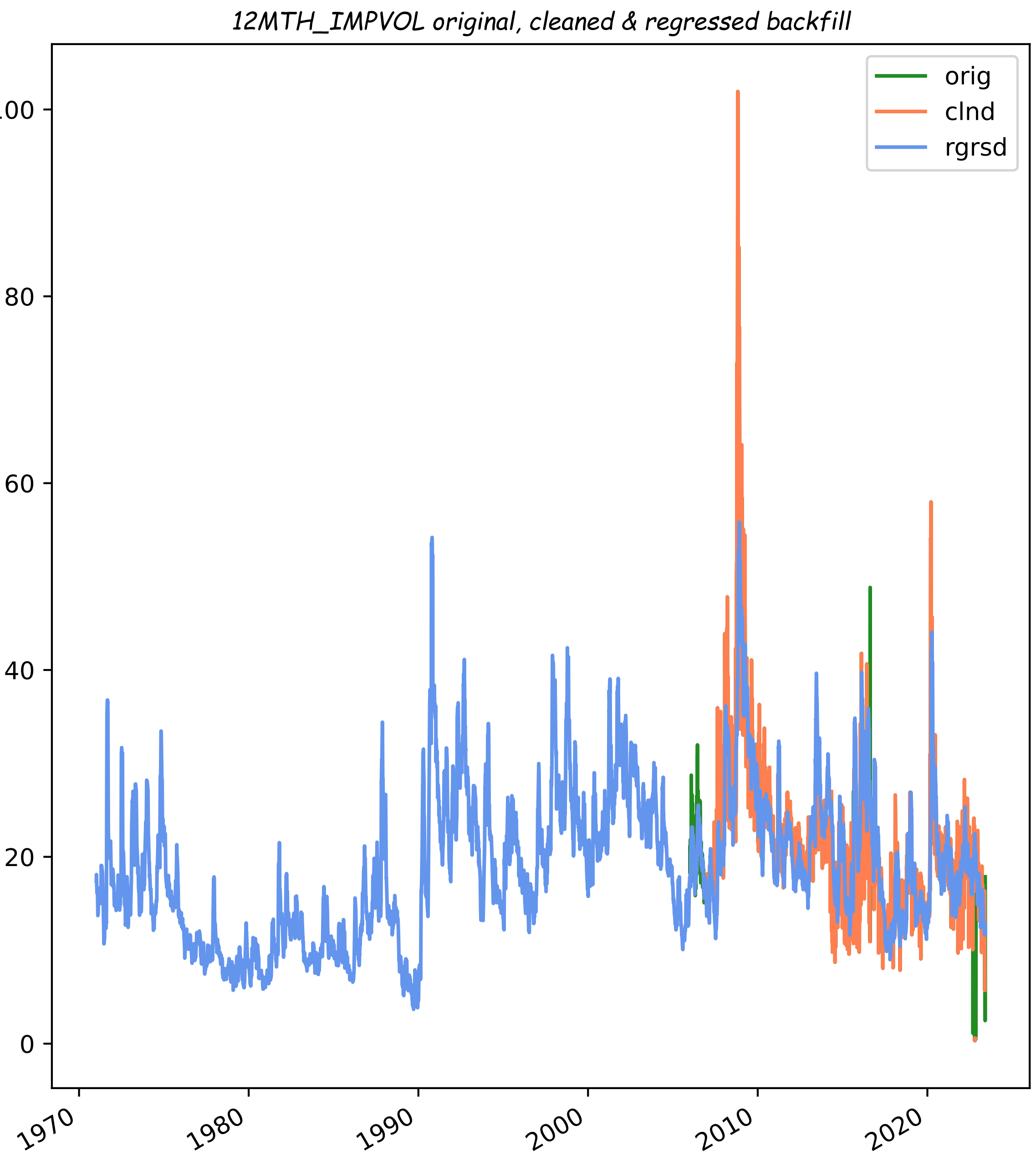
	0		0
ADF Test of Resids.: -8.748 {5% -2.8622, 1% -3.4319			

HG1 Comdty Stats	Value	12MTH_IMPVOL Stats	Value
start	12-06-1988	start	12-08-1989
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	1.654	total_return	-0.130
cagr	0.029	cagr	-0.004
max_drawdown	-0.694	max_drawdown	-0.737
calmar	0.041	calmar	-0.006
mtd	-0.058	mtd	0.060
three_month	-0.110	three_month	-0.060
six_month	-0.023	six_month	-0.172
ytd	-0.043	ytd	-0.035
one_year	-0.152	one_year	0.016
three_year	0.139	three_year	0.051
five_year	0.035	five_year	0.086
ten_year	0.010	ten_year	0.010
incep	0.029	incep	-0.004
daily_sharpe	0.240	daily_sharpe	0.129
daily_sortino	0.394	daily_sortino	0.255
daily_mean	0.062	daily_mean	0.038
daily_vol	0.257	daily_vol	0.294
daily_skew	-0.134	daily_skew	2.574
daily_kurt	2.717	daily_kurt	28.356
best_day	0.078	best_day	0.309
worst_day	-0.104	worst_day	-0.185
monthly_sharpe	0.237	monthly_sharpe	0.155
monthly_sortino	0.431	monthly_sortino	0.359
monthly_mean	0.060	monthly_mean	0.056
monthly_vol	0.255	monthly_vol	0.361
monthly_skew	0.150	monthly_skew	1.367
monthly_kurt	2.659	monthly_kurt	3.424
best_month	0.354	best_month	0.558
worst_month	-0.365	worst_month	-0.215
yearly_sharpe	0.216	yearly_sharpe	0.102
yearly_sortino	0.620	yearly_sortino	0.206
yearly_mean	0.075	yearly_mean	0.025
yearly_vol	0.348	yearly_vol	0.248
yearly_skew	1.577	yearly_skew	0.258
yearly_kurt	4.488	yearly_kurt	-0.553
best_year	1.373	best_year	0.494
worst_year	-0.536	worst_year	-0.435
avg_drawdown	-0.094	avg_drawdown	-0.128
avg_drawdown_days	303.854	avg_drawdown_days	608.350
avg_up_month	0.058	avg_up_month	0.095
avg_down_month	-0.052	avg_down_month	-0.065
win_year_perc	0.514	win_year_perc	0.500
twelve_month_win_perc	0.489	twelve_month_win_perc	0.483



NKY Index 12MTH_IMPVOL [Retro. Stats -- last:12.68 max:101.92 min:0.32 mean:19.00 lvl std (1y,all):3.9,8.4 %-ile:21.9 Z:-0.75]
NKY Index 12MTH_IMPVOL
mean
+-1 zscore 10.6 27.4
-0.5 zscore 14.8
100
80
60
40
20
0
Jan 1971
Jan 1976
Jan 1981
Jan 1986
Jan 1991
Jan 1996
Jan 2001
Jan 2006
Jan 2011
Jan 2016
Jan 2021
Prospective 3sigma (std.lnr) [-3s: 0.18, +3s: 871.88, return std (ln).: 141.0, min(ts.min(252)/ts.max(252)-1): -0.93]





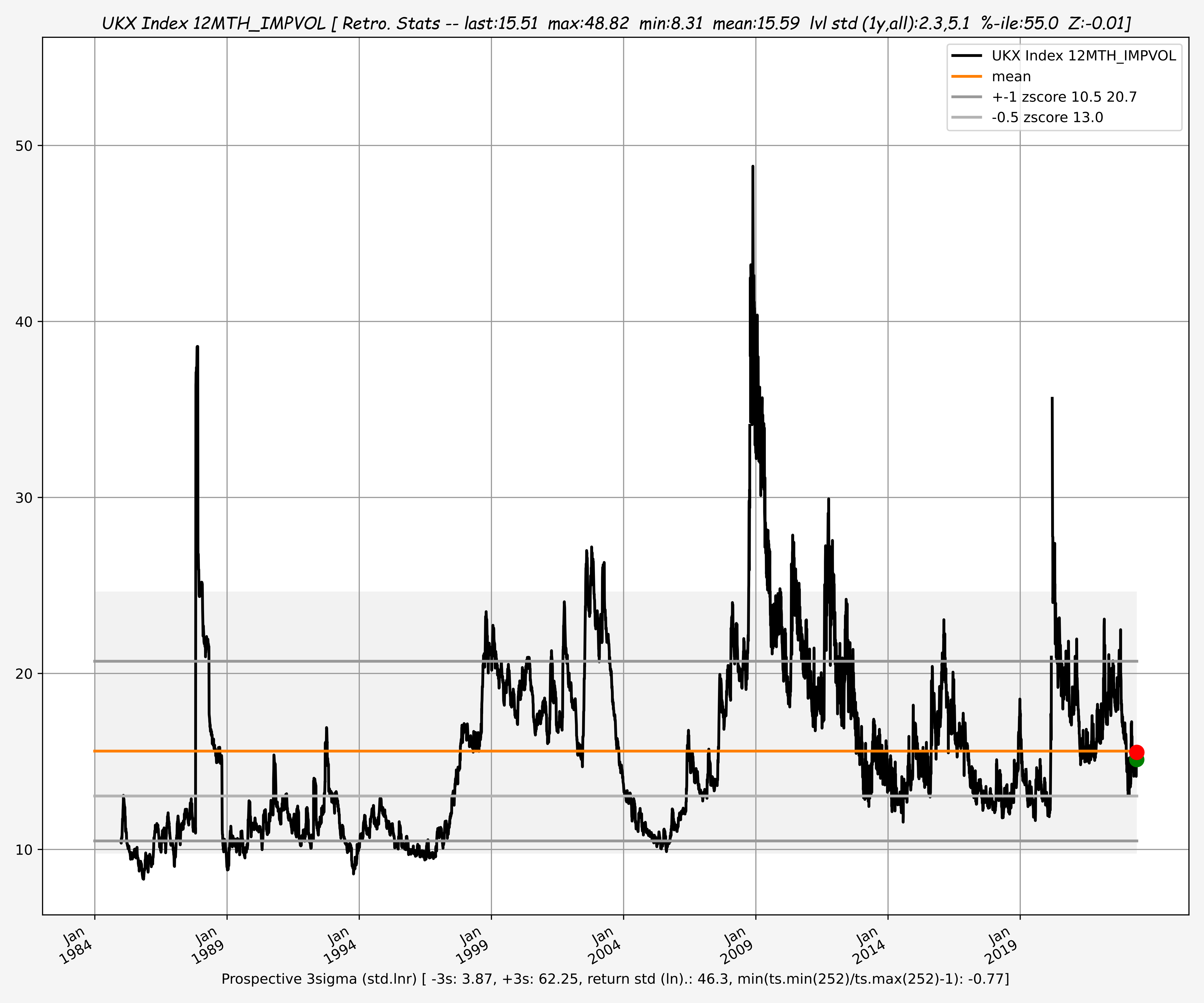
	NKY Index
count	13134.000
mean	14447.746
std	7871.108
min	1929.640
25%	7992.250
50%	14020.050
75%	19898.998
max	38915.870

	12MTH_IMPVOL
count	12899.000
mean	18.922
std	8.005
min	3.675
25%	12.933
50%	17.997
75%	23.755
max	55.825

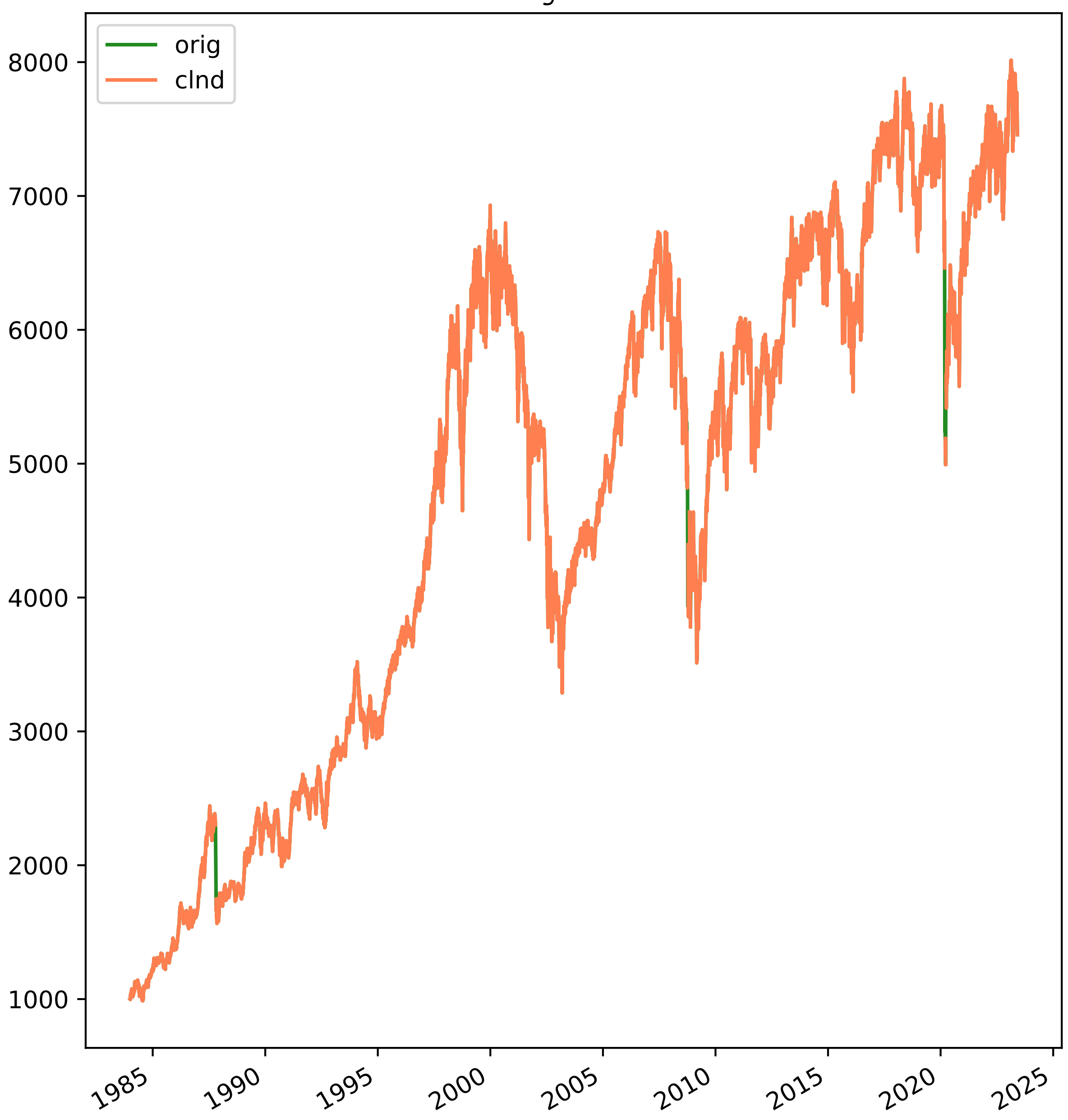
```
                                OLS Regression Results
=======================================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.947
Model:                            OLS   Adj. R-squared (uncentered):              0.947
Method:                 Least Squares   F-statistic:                          1.420e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:44   Log-Likelihood:                         -12467.
No. Observations:                4009   AIC:                                  2.494e+04
Df Residuals:                    4004   BIC:                                  2.498e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1            -0.0001   9.54e-06    -12.780      0.000      -0.000      -0.000
x2             0.4511      0.016     28.153      0.000       0.420       0.483
x3             0.1871      0.022      8.585      0.000       0.144       0.230
x4            -0.0359      0.017     -2.170      0.030      -0.068      -0.003
x5             0.5273      0.024     21.741      0.000       0.480       0.575
==============================================================================
Omnibus:                     2491.446   Durbin-Watson:                   0.302
Prob(Omnibus):                  0.000   Jarque-Bera (JB):            93967.164
Skew:                           2.383   Prob(JB):                         0.00
Kurtosis:                      26.234   Cond. No.                     6.44e+03
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[3] The condition number is large, 6.44e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

	0		0
ADF Test of Resids.: -7.057 {5% -2.8623, 1% -3.4320			

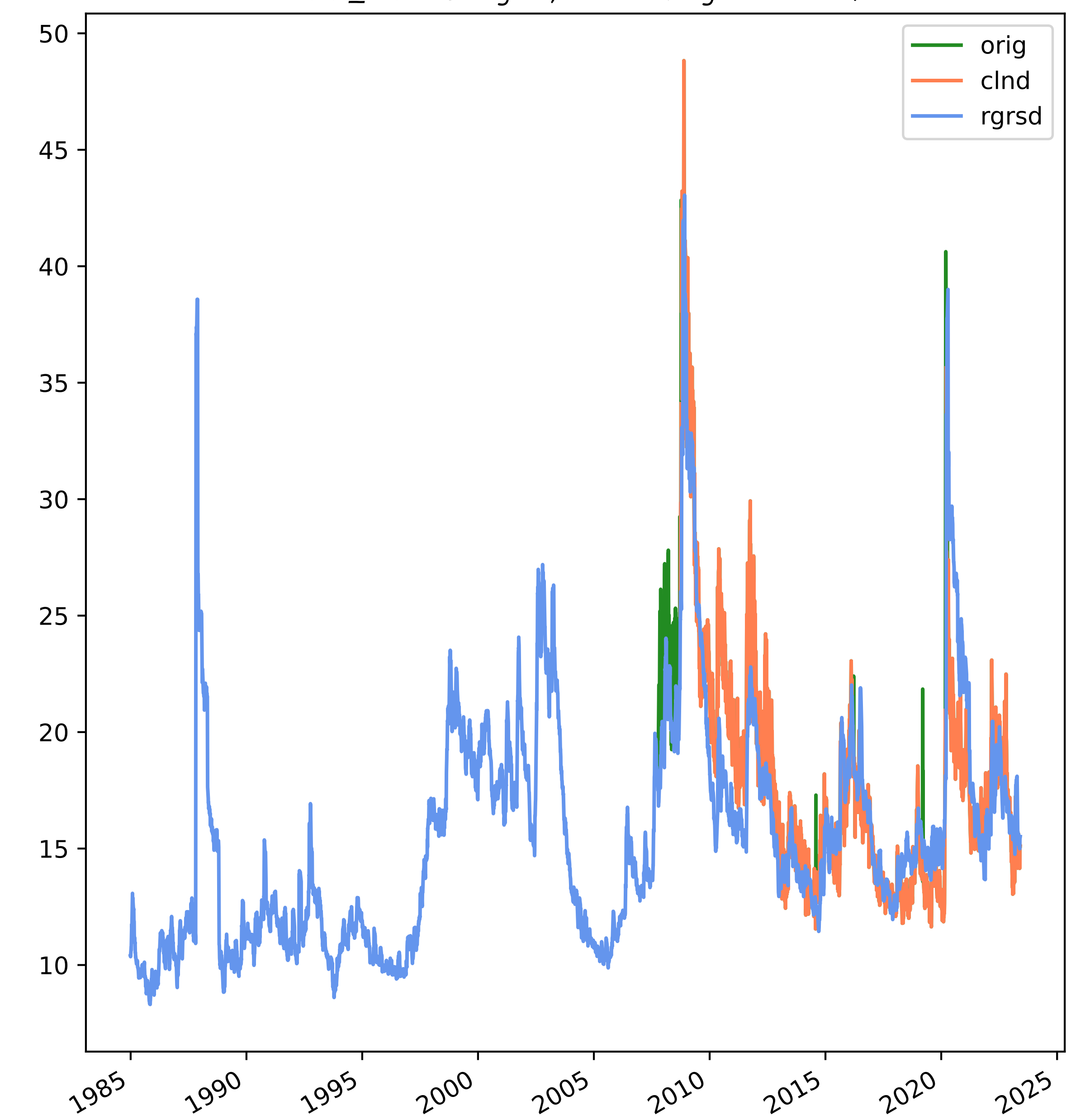
NKY Index Stats	Value	12MTH_IMPVOL Stats	Value
start	01-05-1970	start	01-08-1971
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	11.855	total_return	-0.272
cagr	0.049	cagr	-0.006
max_drawdown	-0.819	max_drawdown	-0.900
calmar	0.060	calmar	-0.007
mtd	0.070	mtd	-0.007
three_month	0.125	three_month	-0.011
six_month	0.104	six_month	-0.301
ytd	0.184	ytd	-0.243
one_year	0.132	one_year	-0.373
three_year	0.119	three_year	-0.222
five_year	0.068	five_year	0.010
ten_year	0.084	ten_year	-0.091
incep	0.049	incep	-0.006
daily_sharpe	0.345	daily_sharpe	0.249
daily_sortino	0.555	daily_sortino	0.494
daily_mean	0.069	daily_mean	0.139
daily_vol	0.200	daily_vol	0.558
daily_skew	0.004	daily_skew	4.081
daily_kurt	6.404	daily_kurt	62.885
best_day	0.169	best_day	0.767
worst_day	-0.082	worst_day	-0.299
monthly_sharpe	0.355	monthly_sharpe	0.339
monthly_sortino	0.586	monthly_sortino	0.916
monthly_mean	0.067	monthly_mean	0.288
monthly_vol	0.188	monthly_vol	0.848
monthly_skew	-0.376	monthly_skew	1.895
monthly_kurt	1.114	monthly_kurt	5.648
best_month	0.201	best_month	1.402
worst_month	-0.238	worst_month	-0.463
yearly_sharpe	0.329	yearly_sharpe	0.167
yearly_sortino	0.762	yearly_sortino	0.954
yearly_mean	0.079	yearly_mean	0.173
yearly_vol	0.240	yearly_vol	1.036
yearly_skew	0.649	yearly_skew	5.144
yearly_kurt	1.957	yearly_kurt	31.858
best_year	0.919	best_year	6.707
worst_year	-0.421	worst_year	-0.631
avg_drawdown	-0.022	avg_drawdown	-0.264
avg_drawdown_days	73.504	avg_drawdown_days	1469.231
avg_up_month	0.042	avg_up_month	0.215
avg_down_month	-0.042	avg_down_month	-0.129
win_year_perc	0.660	win_year_perc	0.442
twelve_month_win_perc	0.633	twelve_month_win_perc	0.490


UKX Index 12MTH_IMPVOL [Retro. Stats -- last:15.51 max:48.82 min:8.31 mean:15.59 lvl std (1y,all):2.3,5.1 %-ile:55.0 Z:-0.01]
UKX Index 12MTH_IMPVOL
mean
+-1 zscore 10.5 20.7
-0.5 zscore 13.0
50
40
30
20
10
Jan 1984
Jan 1989
Jan 1994
Jan 1999
Jan 2004
Jan 2009
Jan 2014
Jan 2019
Prospective 3sigma (std.lnr) [-3s: 3.87, +3s: 62.25, return std (ln).: 46.3, min(ts.min(252)/ts.max(252)-1): -0.77]

UKX Index original & cleaned data



12MTH_IMPVOL original, cleaned & regressed backfill



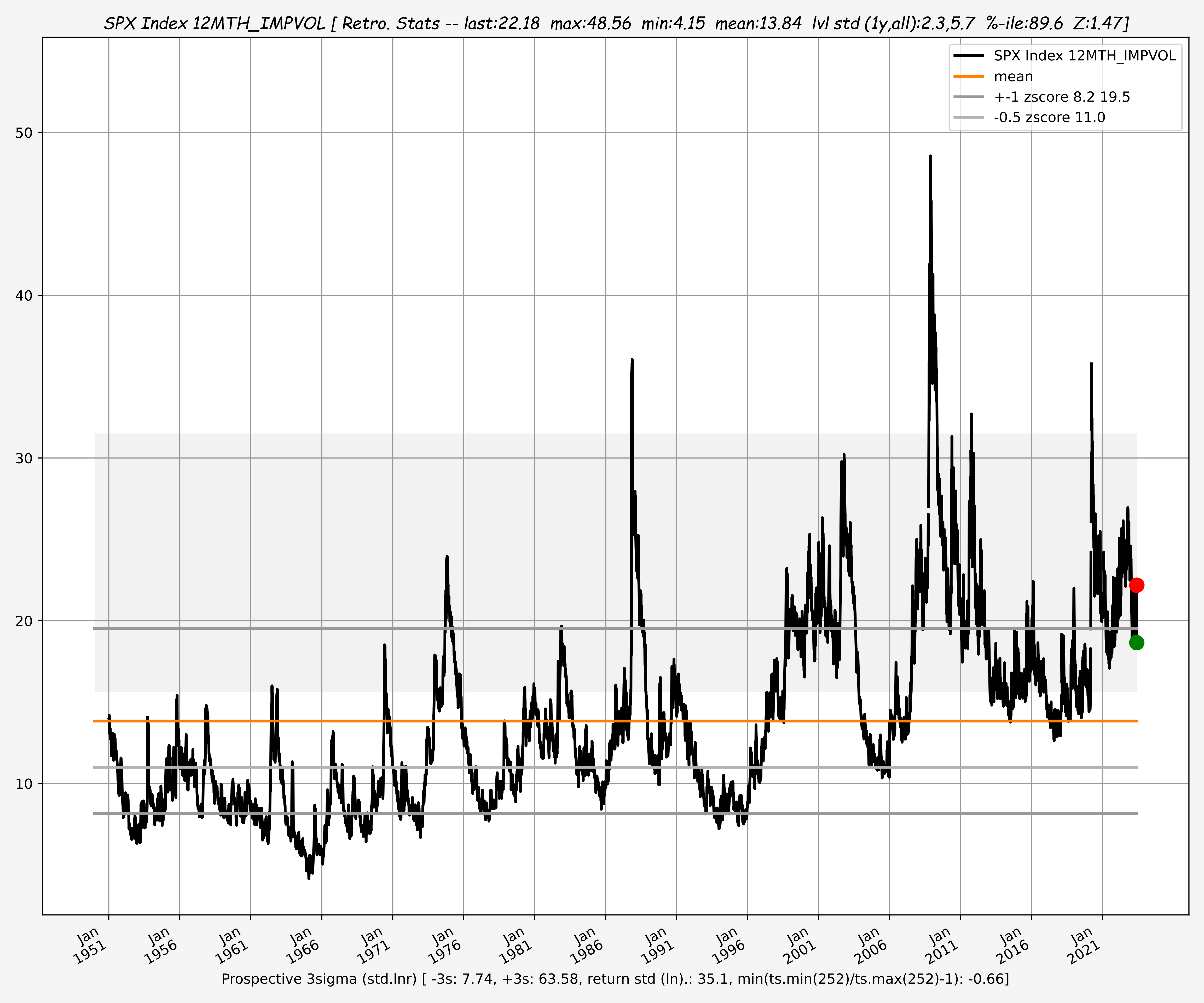
	UKX Index
count	9942.000
mean	4780.308
std	1961.916
min	986.900
25%	3001.375
50%	5267.660
75%	6388.685
max	8014.310

	12MTH_IMPVOL
count	9721.000
mean	15.544
std	4.995
min	8.308
25%	11.537
50%	14.790
75%	17.971
max	43.051

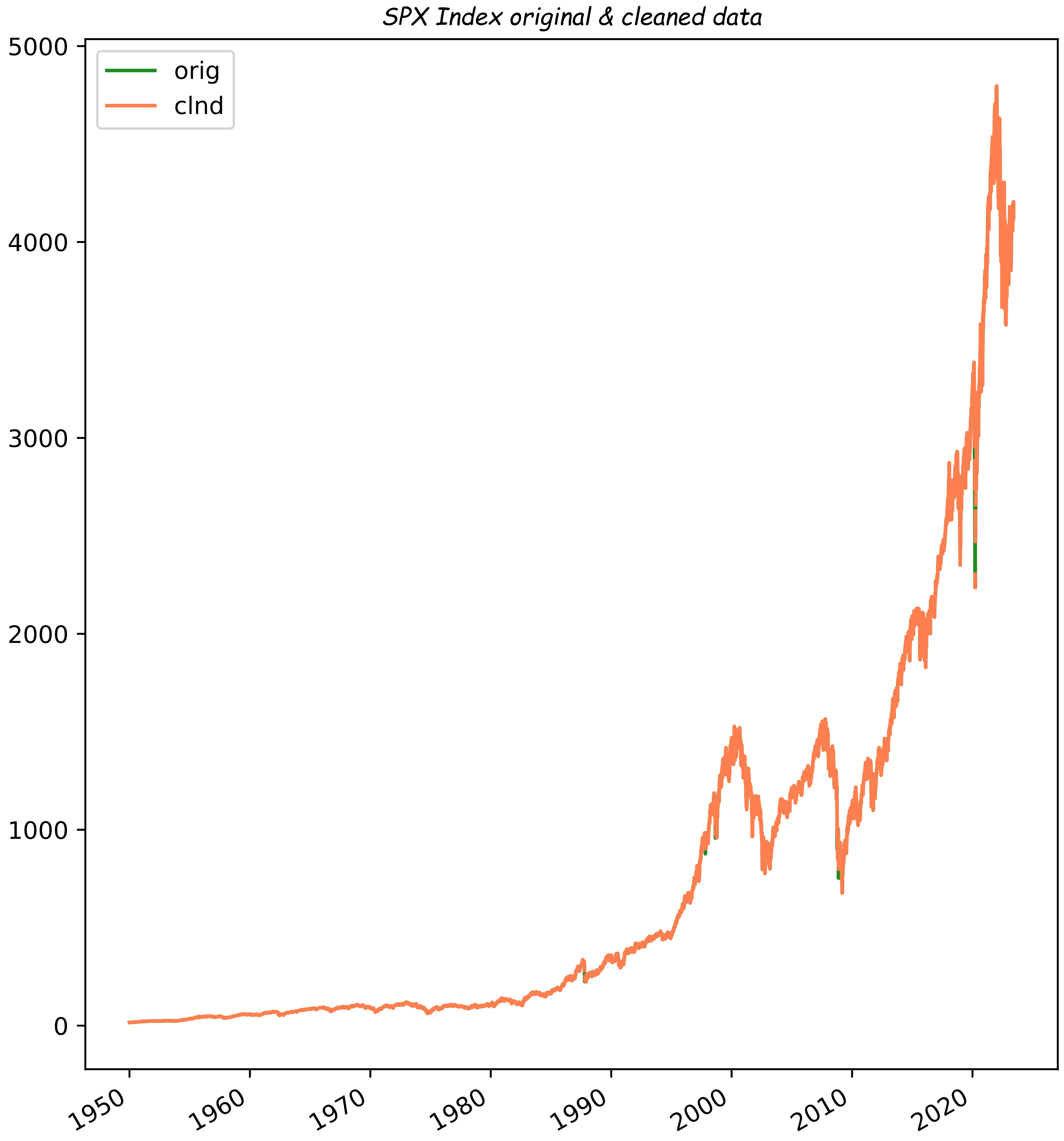
```
                            OLS Regression Results
==============================================================================
Dep. Variable:                      y   R-squared (uncentered):              0.978
Model:                            OLS   Adj. R-squared (uncentered):         0.977
Method:                 Least Squares   F-statistic:                     3.215e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                   0.00
Time:                        10:55:47   Log-Likelihood:                    -9058.4
No. Observations:                3705   AIC:                             1.813e+04
Df Residuals:                    3700   BIC:                             1.816e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0009   1.37e-05     65.568      0.000       0.001       0.001
x2             0.1871      0.007     25.071      0.000       0.172       0.202
x3             0.1427      0.009     15.028      0.000       0.124       0.161
x4             0.0977      0.007     13.612      0.000       0.084       0.112
x5             0.2712      0.010     26.487      0.000       0.251       0.291
==============================================================================
Omnibus:                      313.564   Durbin-Watson:                   0.106
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             1256.578
Skew:                          -0.338   Prob(JB):                    1.37e-273
Kurtosis:                       5.772   Cond. No.                     1.79e+03
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[3] The condition number is large, 1.79e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

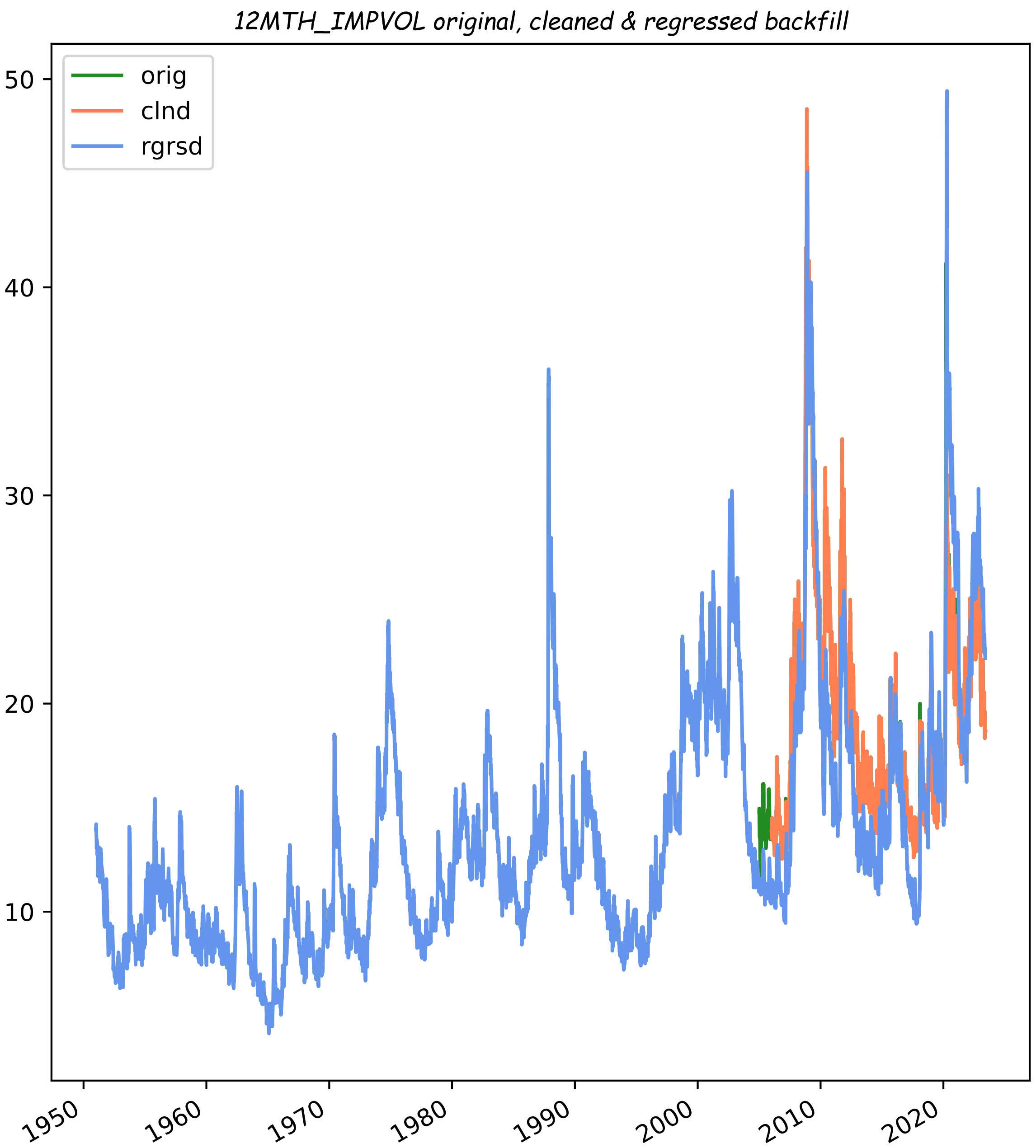
ADF Test of Resids.: -3.198 {5% -2.8623, 1% -3.4321	0

UKX Index Stats	Value	12MTH_IMPVOL Stats	Value
start	12-30-1983	start	12-28-1984
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	6.458	total_return	0.492
cagr	0.052	cagr	0.010
max_drawdown	-0.526	max_drawdown	-0.777
calmar	0.099	calmar	0.013
mtd	-0.052	mtd	0.018
three_month	-0.053	three_month	0.008
six_month	-0.015	six_month	-0.079
ytd	0.001	ytd	-0.036
one_year	-0.020	one_year	-0.181
three_year	0.066	three_year	-0.188
five_year	-0.006	five_year	0.014
ten_year	0.013	ten_year	0.005
incep	0.052	incep	0.010
daily_sharpe	0.376	daily_sharpe	0.158
daily_sortino	0.578	daily_sortino	0.534
daily_mean	0.067	daily_mean	0.073
daily_vol	0.179	daily_vol	0.463
daily_skew	-1.609	daily_skew	54.954
daily_kurt	58.508	daily_kurt	4248.079
best_day	0.182	best_day	2.327
worst_day	-0.268	worst_day	-0.299
monthly_sharpe	0.412	monthly_sharpe	0.188
monthly_sortino	0.655	monthly_sortino	0.628
monthly_mean	0.063	monthly_mean	0.097
monthly_vol	0.153	monthly_vol	0.516
monthly_skew	-0.845	monthly_skew	8.369
monthly_kurt	3.558	monthly_kurt	111.442
best_month	0.144	best_month	2.208
worst_month	-0.260	worst_month	-0.278
yearly_sharpe	0.429	yearly_sharpe	0.179
yearly_sortino	0.844	yearly_sortino	0.440
yearly_mean	0.062	yearly_mean	0.068
yearly_vol	0.144	yearly_vol	0.380
yearly_skew	-0.645	yearly_skew	1.833
yearly_kurt	0.123	yearly_kurt	6.908
best_year	0.351	best_year	1.638
worst_year	-0.313	worst_year	-0.632
avg_drawdown	-0.031	avg_drawdown	-0.167
avg_drawdown_days	72.621	avg_drawdown_days	1164.833
avg_up_month	0.033	avg_up_month	0.097
avg_down_month	-0.035	avg_down_month	-0.055
win_year_perc	0.725	win_year_perc	0.615
twelve_month_win_perc	0.700	twelve_month_win_perc	0.528



SPX Index 12MTH_IMPVOL [Retro. Stats -- last:22.18 max:48.56 min:4.15 mean:13.84 lvl std (1y,all):2.3,5.7 %-ile:89.6 Z:1.47]
SPX Index 12MTH_IMPVOL
mean
+-1 zscore 8.2 19.5
-0.5 zscore 11.0
50
40
30
20
10
Jan 1951
Jan 1956
Jan 1961
Jan 1966
Jan 1971
Jan 1976
Jan 1981
Jan 1986
Jan 1991
Jan 1996
Jan 2001
Jan 2006
Jan 2011
Jan 2016
Jan 2021
Prospective 3sigma (std.lnr) [-3s: 7.74, +3s: 63.58, return std (ln).: 35.1, min(ts.min(252)/ts.max(252)-1): -0.66]



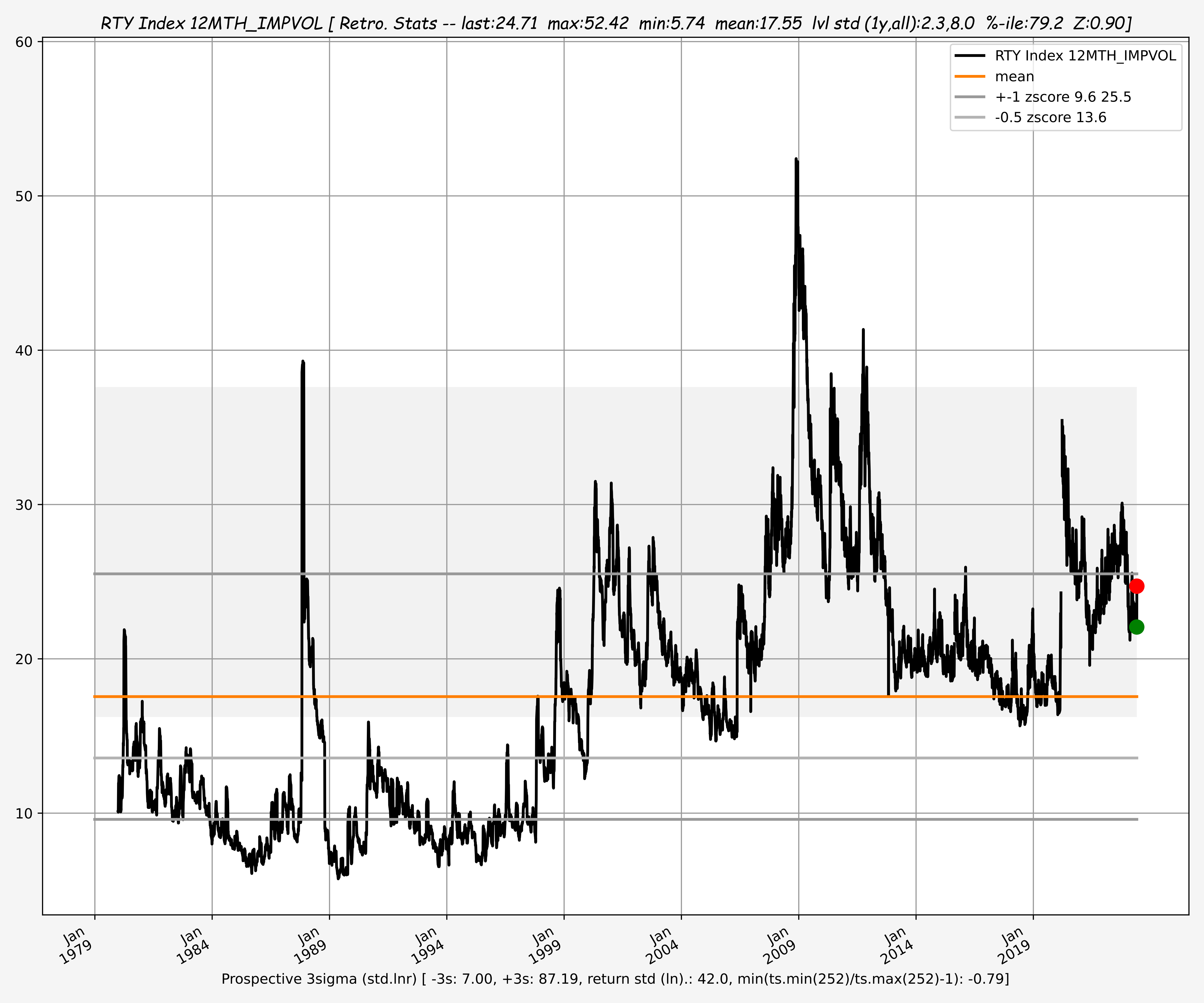


	SPX Index
count	18436.000
mean	753.904
std	997.206
min	16.660
25%	88.148
50%	242.205
75%	1194.655
max	4796.560

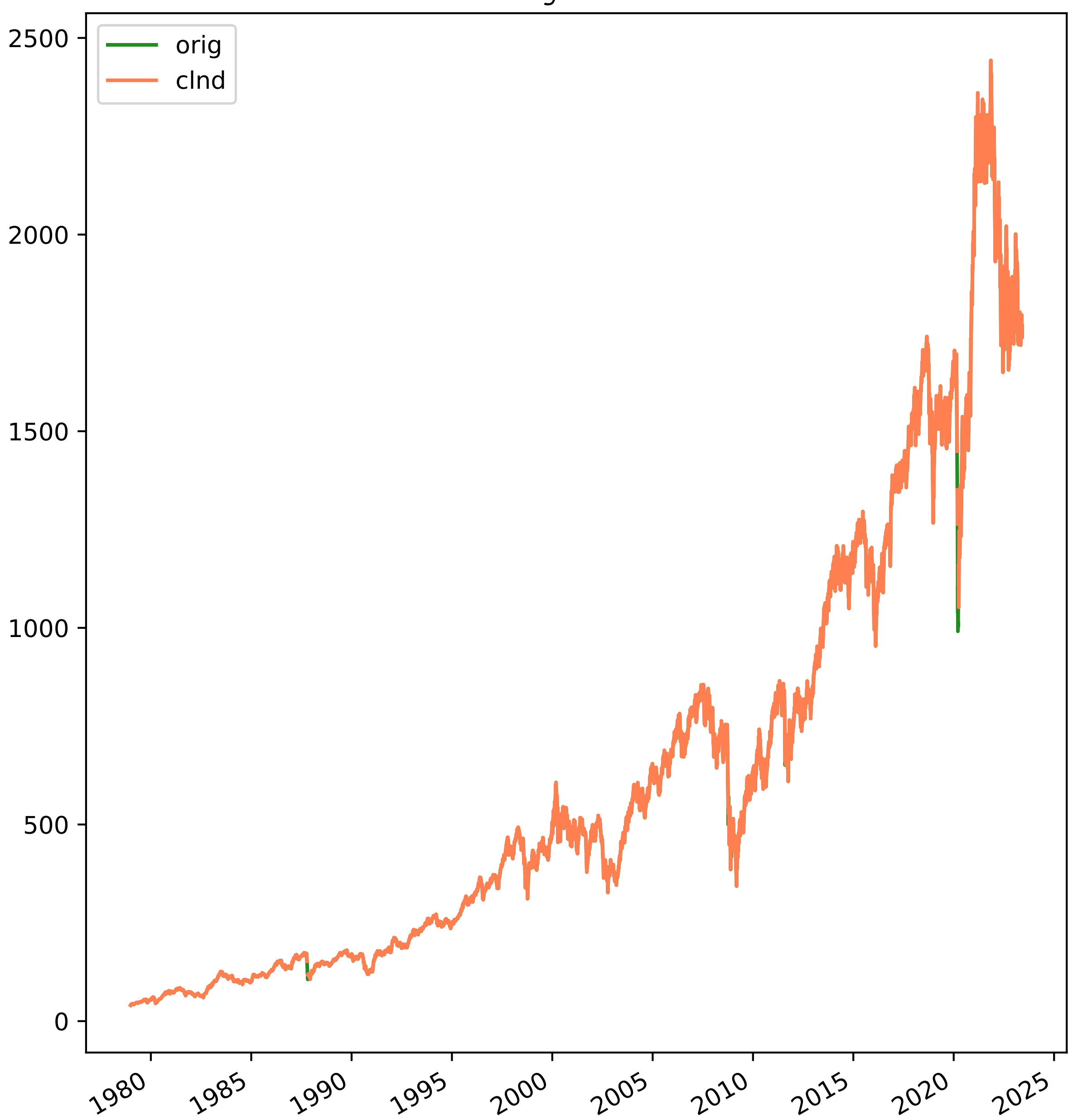
	12MTH_IMPVOL
count	18221.000
mean	13.635
std	5.914
min	4.150
25%	9.430
50%	12.079
75%	16.275
max	49.435

```
                            OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                  0.965
Model:                            OLS   Adj. R-squared (uncentered):             0.965
Method:                 Least Squares   F-statistic:                         2.435e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                       0.00
Time:                        10:55:49   Log-Likelihood:                        -12017.
No. Observations:                4381   AIC:                                 2.404e+04
Df Residuals:                    4376   BIC:                                 2.408e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0015   4.11e-05     37.039      0.000       0.001       0.002
x2             0.2615      0.010     26.413      0.000       0.242       0.281
x3             0.1319      0.013     10.465      0.000       0.107       0.157
x4             0.1043      0.009     11.056      0.000       0.086       0.123
x5             0.4112      0.013     30.749      0.000       0.385       0.437
==============================================================================
Omnibus:                     1196.403   Durbin-Watson:                   0.036
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             4225.728
Skew:                          -1.340   Prob(JB):                         0.00
Kurtosis:                       6.995   Cond. No.                         694.
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

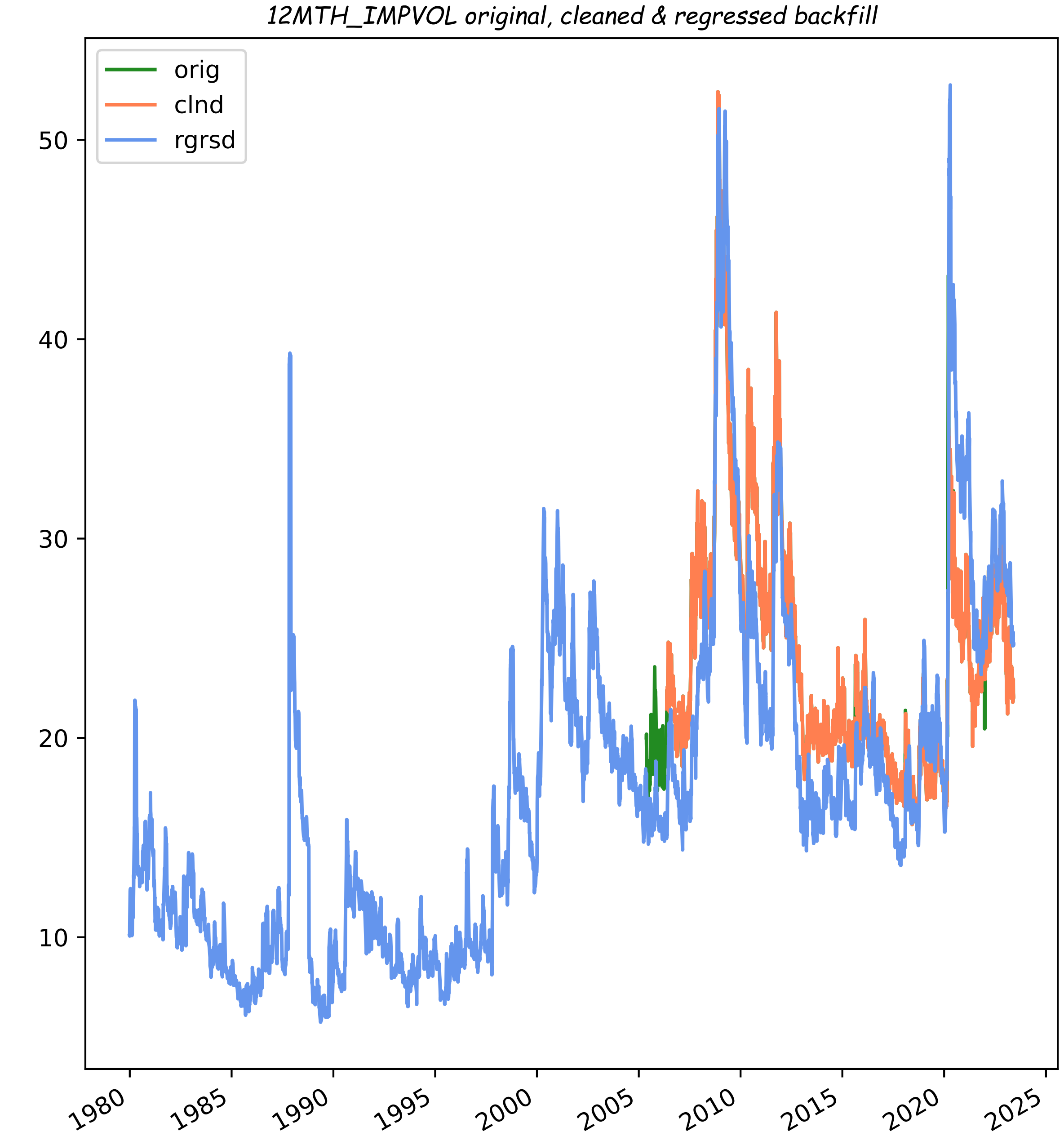
ADF Test of Resids.: -3.035 {5% -2.8622, 1% -3.4319	0		0
SPX Index Stats	Value	12MTH_IMPVOL Stats	Value
start	01-03-1950	start	01-05-1951
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	249.237	total_return	0.590
cagr	0.078	cagr	0.006
max_drawdown	-0.568	max_drawdown	-0.800
calmar	0.138	calmar	0.008
mtd	-0.000	mtd	-0.046
three_month	0.050	three_month	-0.115
six_month	0.022	six_month	-0.245
ytd	0.086	ytd	-0.145
one_year	0.009	one_year	-0.191
three_year	0.109	three_year	-0.124
five_year	0.090	five_year	0.070
ten_year	0.098	ten_year	0.054
incep	0.078	incep	0.006
daily_sharpe	0.571	daily_sharpe	0.179
daily_sortino	0.916	daily_sortino	0.360
daily_mean	0.087	daily_mean	0.061
daily_vol	0.153	daily_vol	0.343
daily_skew	-0.210	daily_skew	6.812
daily_kurt	21.783	daily_kurt	202.432
best_day	0.174	best_day	0.871
worst_day	-0.175	worst_day	-0.274
monthly_sharpe	0.587	monthly_sharpe	0.220
monthly_sortino	0.992	monthly_sortino	0.581
monthly_mean	0.086	monthly_mean	0.110
monthly_vol	0.147	monthly_vol	0.501
monthly_skew	-0.608	monthly_skew	3.137
monthly_kurt	3.074	monthly_kurt	21.391
best_month	0.163	best_month	1.419
worst_month	-0.272	worst_month	-0.342
yearly_sharpe	0.536	yearly_sharpe	0.201
yearly_sortino	1.190	yearly_sortino	0.562
yearly_mean	0.089	yearly_mean	0.084
yearly_vol	0.166	yearly_vol	0.418
yearly_skew	-0.445	yearly_skew	1.022
yearly_kurt	0.023	yearly_kurt	0.756
best_year	0.450	best_year	1.344
worst_year	-0.385	worst_year	-0.535
avg_drawdown	-0.024	avg_drawdown	-0.205
avg_drawdown_days	39.290	avg_drawdown_days	941.214
avg_up_month	0.033	avg_up_month	0.117
avg_down_month	-0.032	avg_down_month	-0.074
win_year_perc	0.726	win_year_perc	0.458
twelve_month_win_perc	0.732	twelve_month_win_perc	0.508


RTY Index 12MTH_IMPVOL [Retro. Stats -- last:24.71 max:52.42 min:5.74 mean:17.55 lvl std (1y,all):2.3,8.0 %-ile:79.2 Z:0.90]
RTY Index 12MTH_IMPVOL
mean
+-1 zscore 9.6 25.5
-0.5 zscore 13.6
60
50
40
30
20
10
Jan 1979
Jan 1984
Jan 1989
Jan 1994
Jan 1999
Jan 2004
Jan 2009
Jan 2014
Jan 2019
Prospective 3sigma (std.lnr) [-3s: 7.00, +3s: 87.19, return std (ln).: 42.0, min(ts.min(252)/ts.max(252)-1): -0.79]

RTY Index original & cleaned data



12MTH_IMPVOL original, cleaned & regressed backfill

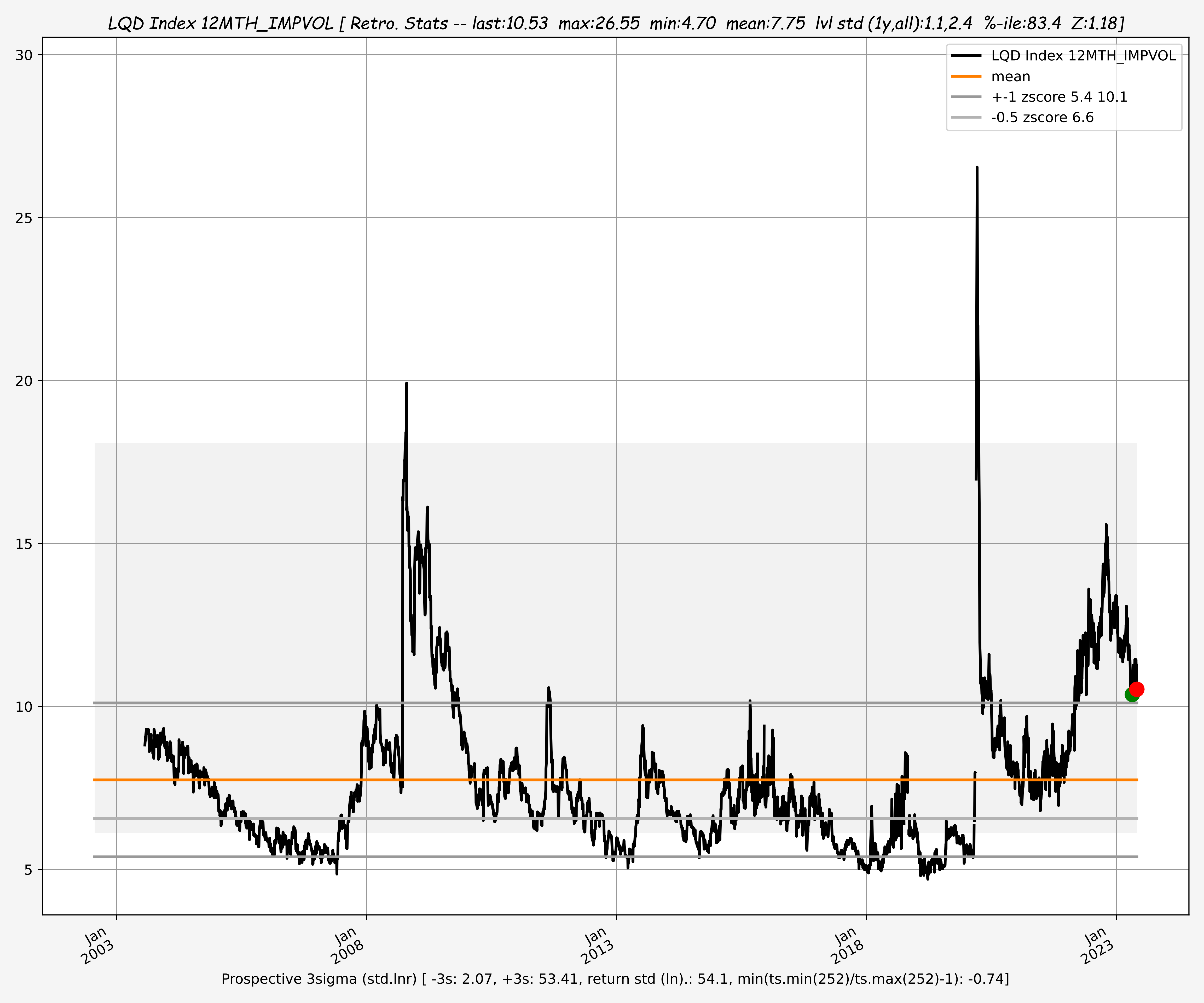


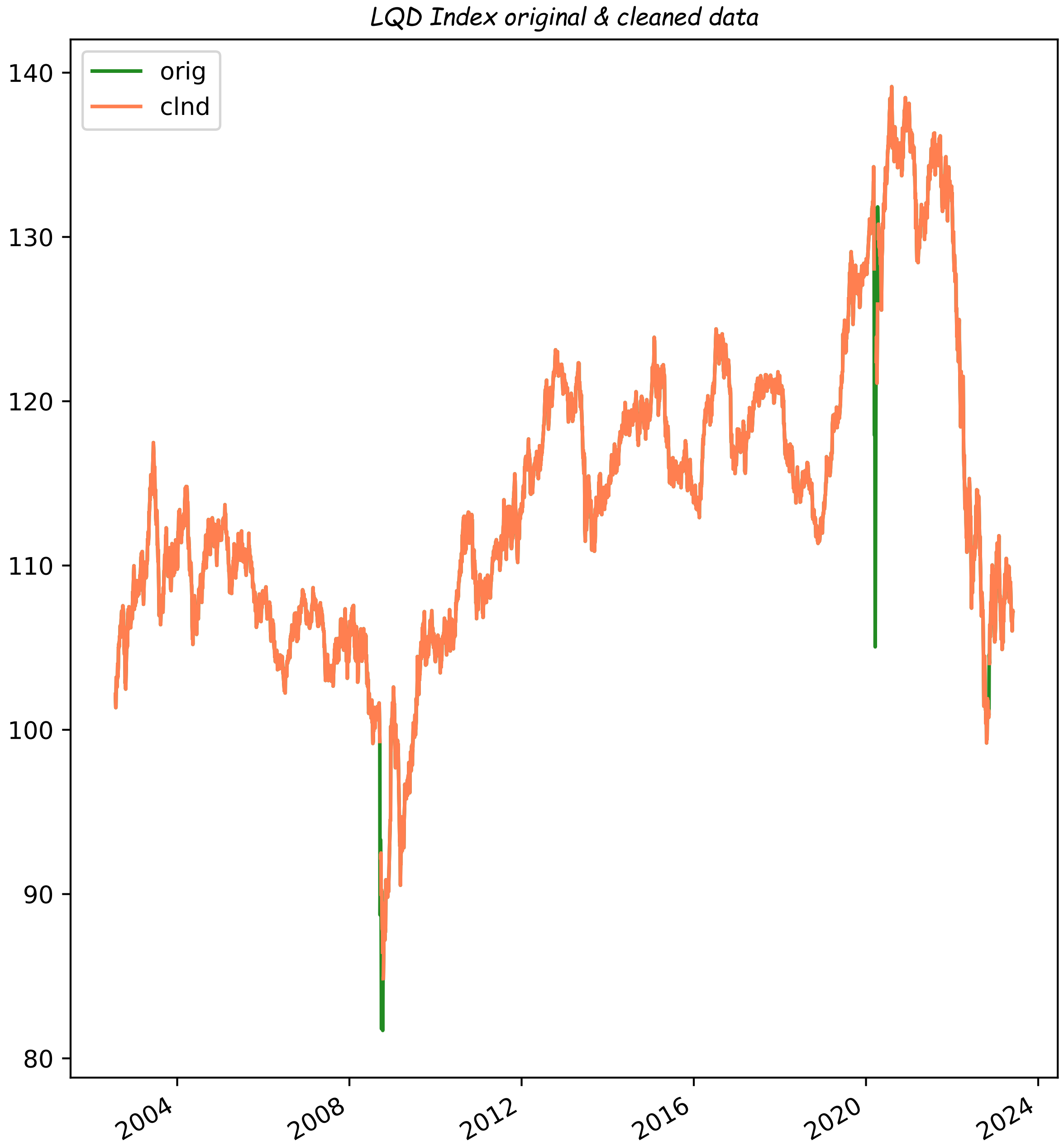
	RTY Index
count	11280.000
mean	618.048
std	552.558
min	40.237
25%	166.161
50%	454.467
75%	823.765
max	2442.742

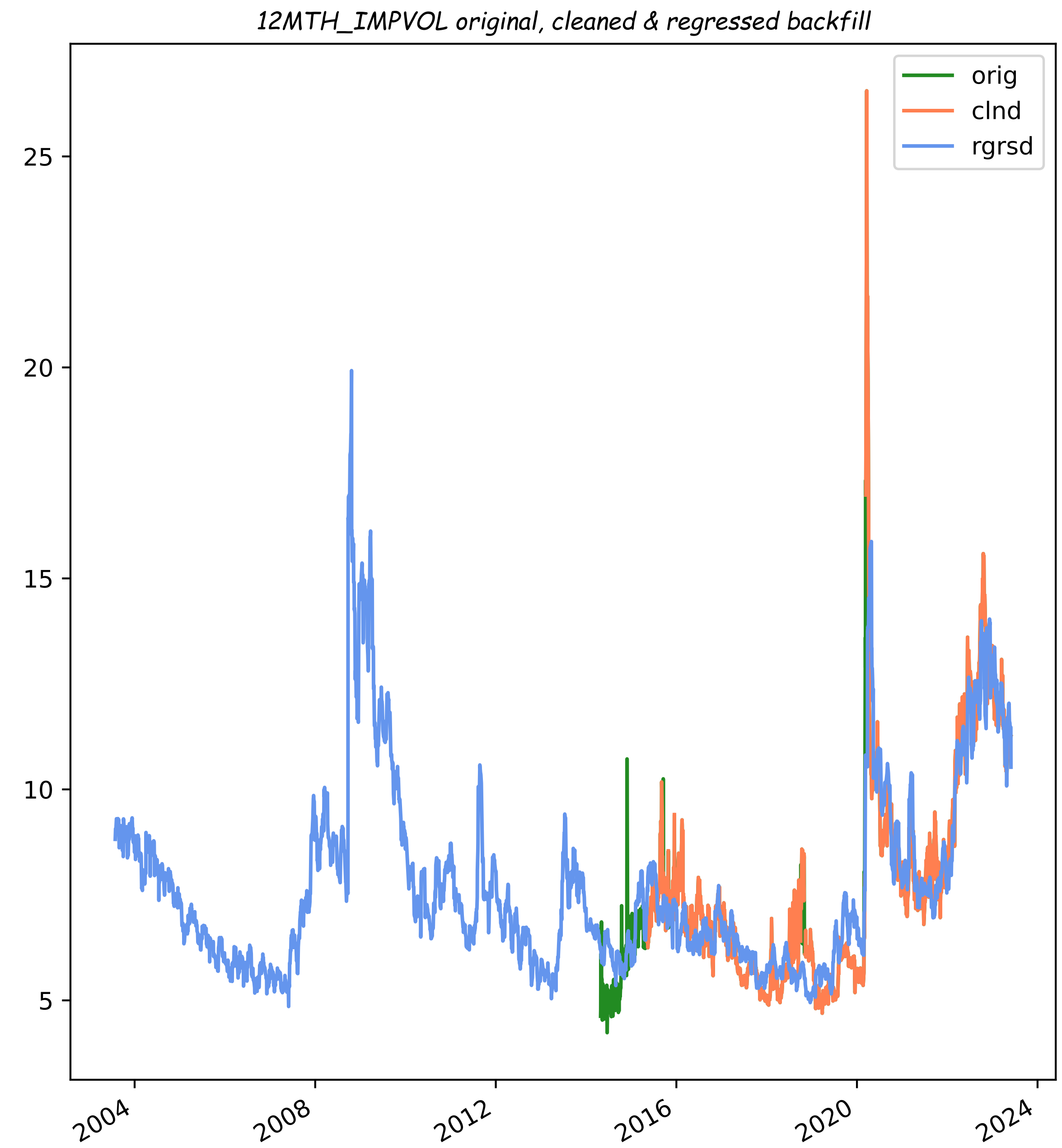
	12MTH_IMPVOL
count	11053.000
mean	17.222
std	8.219
min	5.741
25%	10.275
50%	16.341
75%	21.205
max	52.754

```
                                 OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.970
Model:                            OLS   Adj. R-squared (uncentered):              0.970
Method:                 Least Squares   F-statistic:                          2.726e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:52   Log-Likelihood:                         -12409.
No. Observations:                4286   AIC:                                  2.483e+04
Df Residuals:                    4281   BIC:                                  2.486e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0027   9.47e-05     28.284      0.000       0.002       0.003
x2             0.2777      0.012     23.344      0.000       0.254       0.301
x3             0.1169      0.015      7.878      0.000       0.088       0.146
x4             0.0865      0.010      8.427      0.000       0.066       0.107
x5             0.4243      0.014     30.470      0.000       0.397       0.452
==============================================================================
Omnibus:                      698.681   Durbin-Watson:                   0.030
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             1312.705
Skew:                          -1.014   Prob(JB):                    8.91e-286
Kurtosis:                       4.800   Cond. No.                         353.
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

ADF Test of Resids.: -2.722 {5% -2.8622, 1% -3.4319	0		0
RTY Index Stats	Value	12MTH_IMPVOL Stats	Value
start	12-29-1978	start	12-28-1979
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	42.262	total_return	1.447
cagr	0.089	cagr	0.021
max_drawdown	-0.599	max_drawdown	-0.854
calmar	0.148	calmar	0.024
mtd	-0.016	mtd	-0.028
three_month	-0.082	three_month	-0.101
six_month	-0.077	six_month	-0.222
ytd	-0.012	ytd	-0.117
one_year	-0.066	one_year	-0.206
three_year	0.074	three_year	-0.145
five_year	0.013	five_year	0.090
ten_year	0.059	ten_year	0.042
incep	0.089	incep	0.021
daily_sharpe	0.529	daily_sharpe	0.216
daily_sortino	0.817	daily_sortino	0.541
daily_mean	0.103	daily_mean	0.104
daily_vol	0.196	daily_vol	0.481
daily_skew	-0.768	daily_skew	34.951
daily_kurt	19.544	daily_kurt	2459.802
best_day	0.156	best_day	2.185
worst_day	-0.225	worst_day	-0.413
monthly_sharpe	0.533	monthly_sharpe	0.256
monthly_sortino	0.874	monthly_sortino	0.796
monthly_mean	0.105	monthly_mean	0.176
monthly_vol	0.197	monthly_vol	0.685
monthly_skew	-0.724	monthly_skew	6.733
monthly_kurt	2.524	monthly_kurt	82.808
best_month	0.183	best_month	2.821
worst_month	-0.307	worst_month	-0.409
yearly_sharpe	0.563	yearly_sharpe	0.226
yearly_sortino	1.371	yearly_sortino	0.625
yearly_mean	0.103	yearly_mean	0.103
yearly_vol	0.183	yearly_vol	0.457
yearly_skew	-0.298	yearly_skew	1.318
yearly_kurt	-0.304	yearly_kurt	2.387
best_year	0.454	best_year	1.650
worst_year	-0.348	worst_year	-0.701
avg_drawdown	-0.031	avg_drawdown	-0.151
avg_drawdown_days	45.036	avg_drawdown_days	751.429
avg_up_month	0.044	avg_up_month	0.132
avg_down_month	-0.046	avg_down_month	-0.083
win_year_perc	0.667	win_year_perc	0.523
twelve_month_win_perc	0.683	twelve_month_win_perc	0.509


LQD Index 12MTH_IMPVOL [Retro. Stats -- last:10.53 max:26.55 min:4.70 mean:7.75 lvl std (1y,all):1.1,2.4 %-ile:83.4 Z:1.18]
LQD Index 12MTH_IMPVOL
mean
+-1 zscore 5.4 10.1
-0.5 zscore 6.6
30
25
20
15
10
5
Jan 2003
Jan 2008
Jan 2013
Jan 2018
Jan 2023
Prospective 3sigma (std.lnr) [-3s: 2.07, +3s: 53.41, return std (ln).: 54.1, min(ts.min(252)/ts.max(252)-1): -0.74]





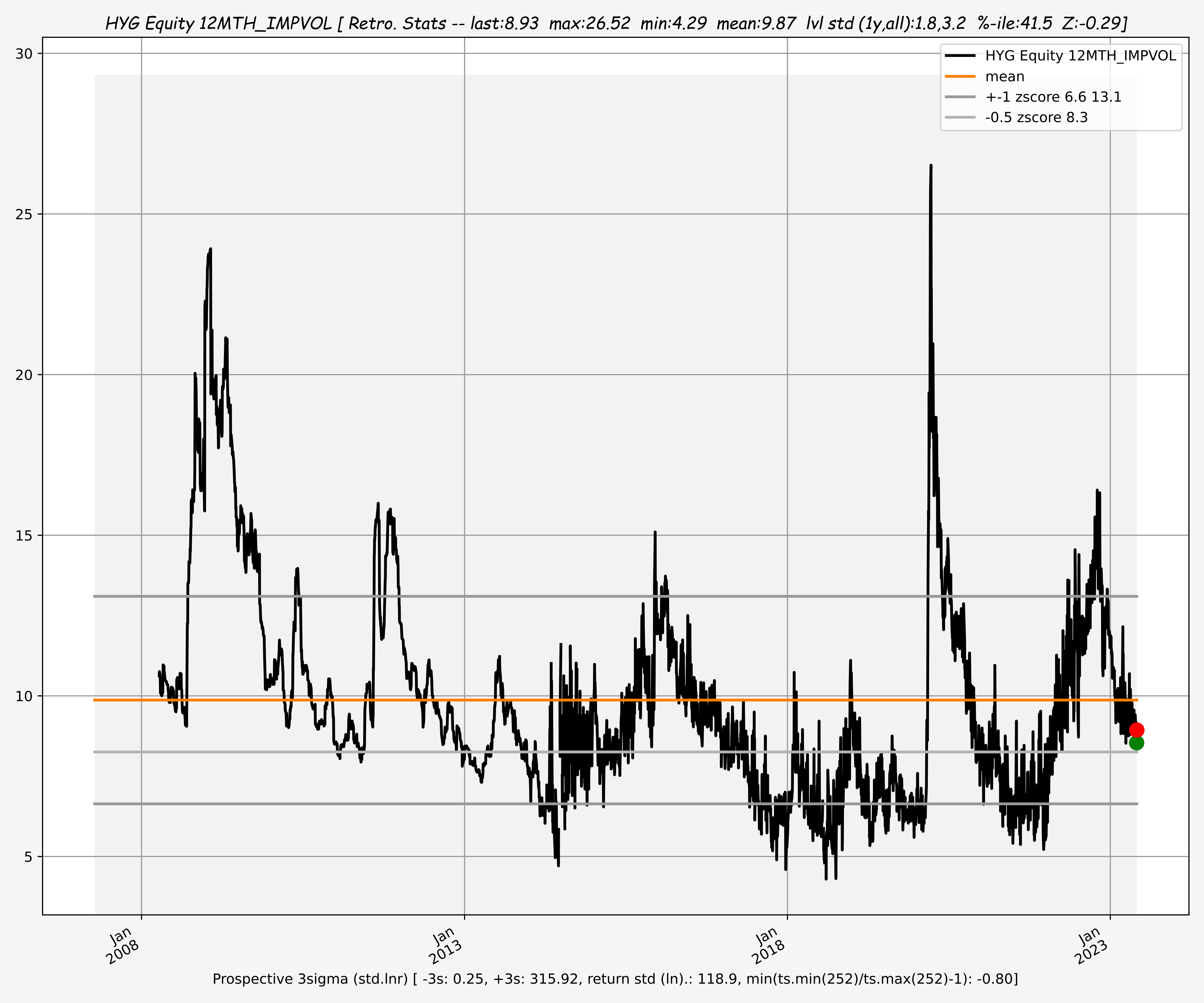
	LQD Index
count	5223.000
mean	114.159
std	9.251
min	84.850
25%	107.440
50%	113.180
75%	119.540
max	139.150

	12MTH_IMPVOL
count	4996.000
mean	7.741
std	2.240
min	4.855
25%	6.168
50%	7.139
75%	8.436
max	19.924

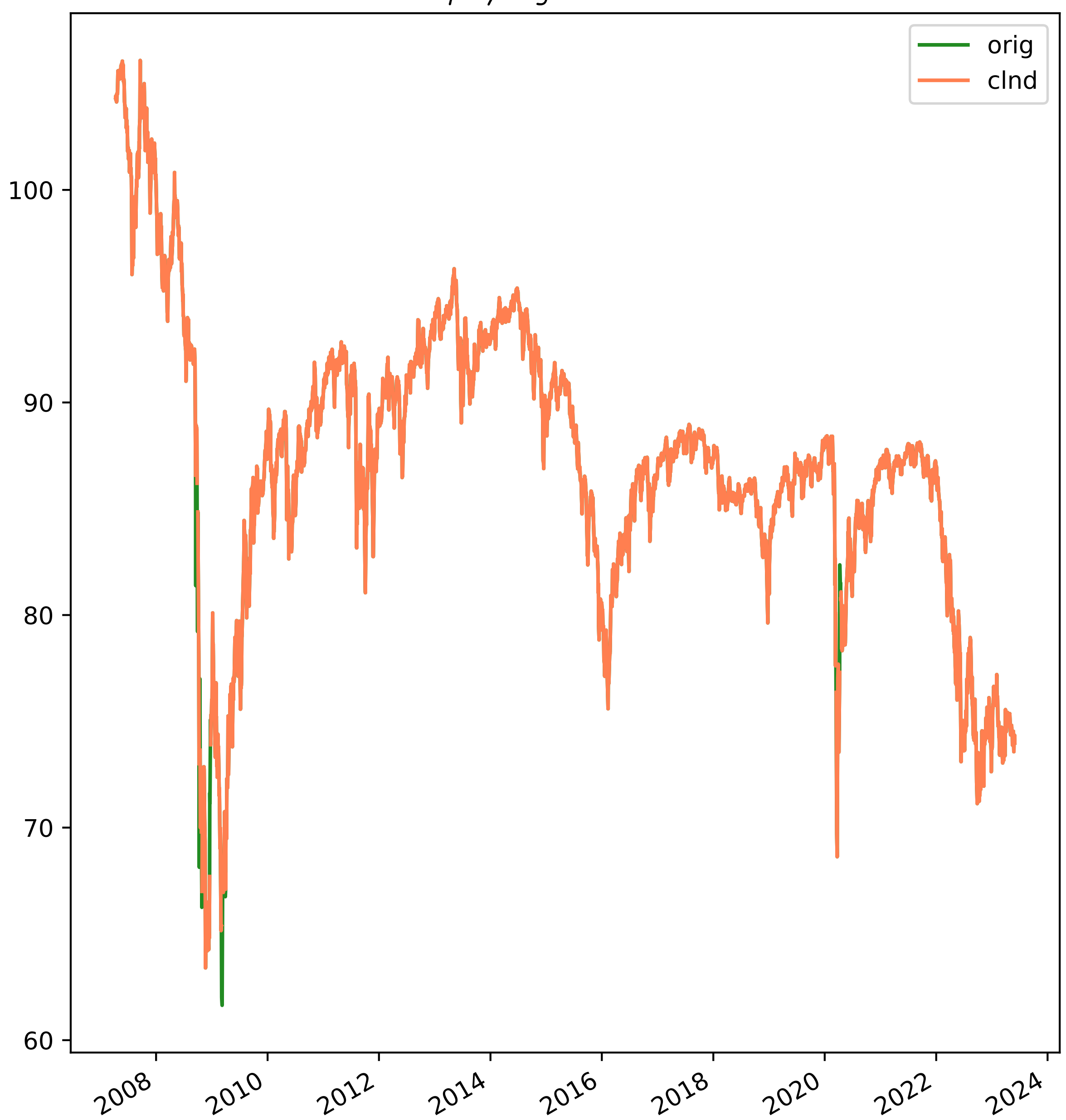
```
                                 OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.977
Model:                            OLS   Adj. R-squared (uncentered):              0.977
Method:                 Least Squares   F-statistic:                          1.709e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:54   Log-Likelihood:                         -3364.4
No. Observations:                2037   AIC:                                      6739.
Df Residuals:                    2032   BIC:                                      6767.
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0167      0.001     25.582      0.000       0.015       0.018
x2             0.3896      0.018     22.094      0.000       0.355       0.424
x3             0.1035      0.023      4.449      0.000       0.058       0.149
x4             0.1656      0.018      9.440      0.000       0.131       0.200
x5             0.2448      0.028      8.609      0.000       0.189       0.301
==============================================================================
Omnibus:                     1982.311   Durbin-Watson:                   0.132
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           195634.273
Skew:                           4.355   Prob(JB):                         0.00
Kurtosis:                      50.214   Cond. No.                         146.
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

	0
ADF Test of Resids.: -7.542 {5% -2.8630, 1% -3.4336	0

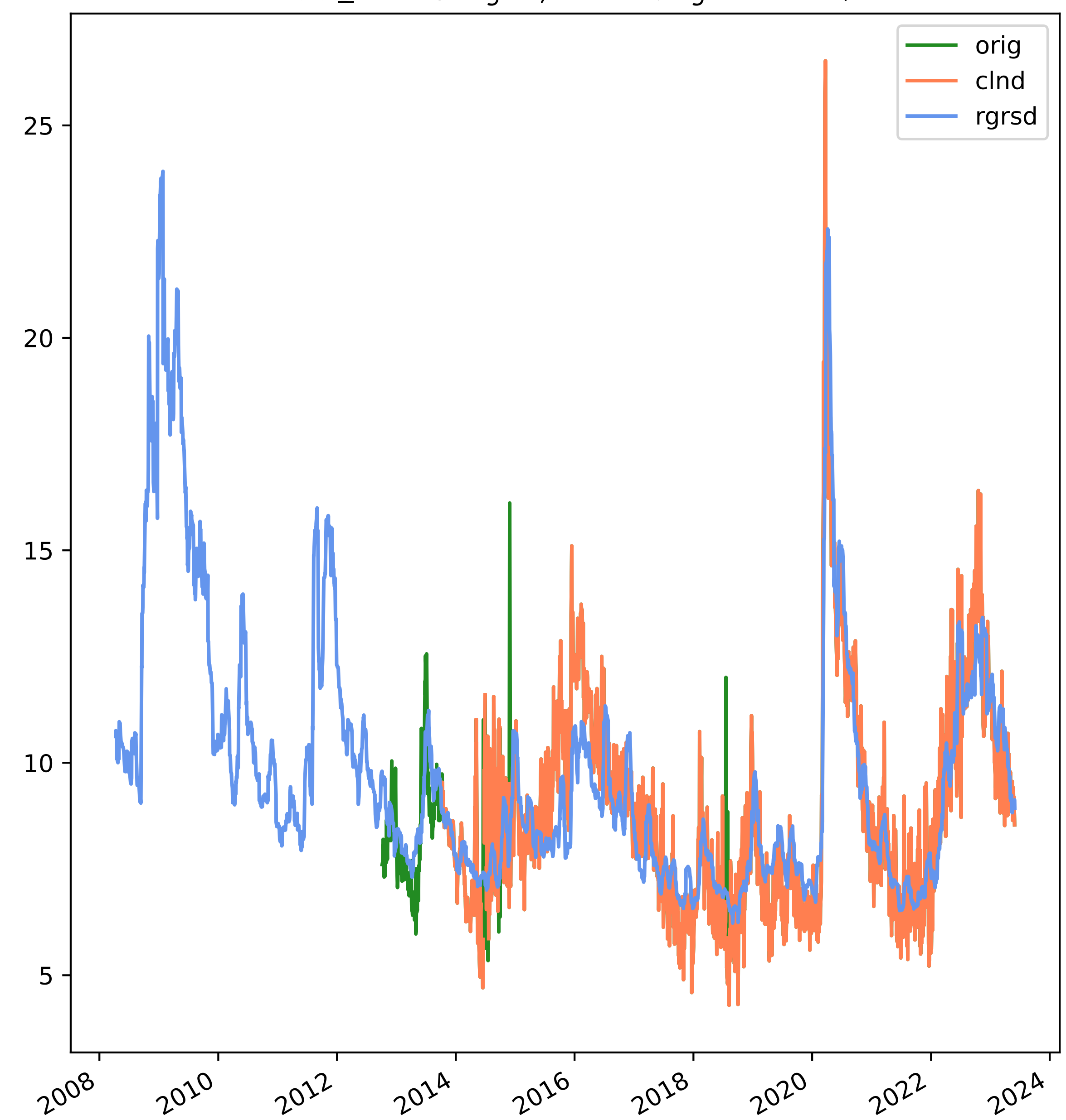
LQD Index Stats	Value	12MTH_IMPVOL Stats	Value
start	07-26-2002	start	07-28-2003
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	0.050	total_return	0.194
cagr	0.002	cagr	0.009
max_drawdown	-0.287	max_drawdown	-0.752
calmar	0.008	calmar	0.012
mtd	-0.025	mtd	0.027
three_month	0.012	three_month	-0.131
six_month	-0.005	six_month	-0.226
ytd	0.017	ytd	-0.161
one_year	-0.063	one_year	-0.041
three_year	-0.066	three_year	0.001
five_year	-0.015	five_year	0.115
ten_year	-0.009	ten_year	0.048
incep	0.002	incep	0.009
daily_sharpe	0.069	daily_sharpe	0.194
daily_sortino	0.105	daily_sortino	0.432
daily_mean	0.005	daily_mean	0.081
daily_vol	0.072	daily_vol	0.420
daily_skew	-0.998	daily_skew	18.563
daily_kurt	16.344	daily_kurt	804.696
best_day	0.032	best_day	1.182
worst_day	-0.070	worst_day	-0.196
monthly_sharpe	0.070	monthly_sharpe	0.200
monthly_sortino	0.111	monthly_sortino	0.525
monthly_mean	0.005	monthly_mean	0.092
monthly_vol	0.078	monthly_vol	0.460
monthly_skew	-0.029	monthly_skew	3.874
monthly_kurt	6.122	monthly_kurt	27.063
best_month	0.128	best_month	1.066
worst_month	-0.109	worst_month	-0.279
yearly_sharpe	0.019	yearly_sharpe	0.161
yearly_sortino	0.027	yearly_sortino	0.420
yearly_mean	0.001	yearly_mean	0.048
yearly_vol	0.069	yearly_vol	0.299
yearly_skew	-1.051	yearly_skew	0.837
yearly_kurt	3.271	yearly_kurt	-0.098
best_year	0.134	best_year	0.649
worst_year	-0.204	worst_year	-0.408
avg_drawdown	-0.024	avg_drawdown	-0.115
avg_drawdown_days	139.830	avg_drawdown_days	450.750
avg_up_month	0.015	avg_up_month	0.093
avg_down_month	-0.016	avg_down_month	-0.070
win_year_perc	0.571	win_year_perc	0.450
twelve_month_win_perc	0.521	twelve_month_win_perc	0.456


HYG Equity 12MTH_IMPVOL [Retro. Stats -- last:8.93 max:26.52 min:4.29 mean:9.87 lvl std (1y,all):1.8,3.2 %-ile:41.5 Z:-0.29]
HYG Equity 12MTH_IMPVOL
mean
+-1 zscore 6.6 13.1
-0.5 zscore 8.3
30
25
20
15
10
5
Jan 2008
Jan 2013
Jan 2018
Jan 2023
Prospective 3sigma (std.lnr) [-3s: 0.25, +3s: 315.92, return std (ln).: 118.9, min(ts.min(252)/ts.max(252)-1): -0.80]

HYG Equity original & cleaned data



12MTH_IMPVOL original, cleaned & regressed backfill



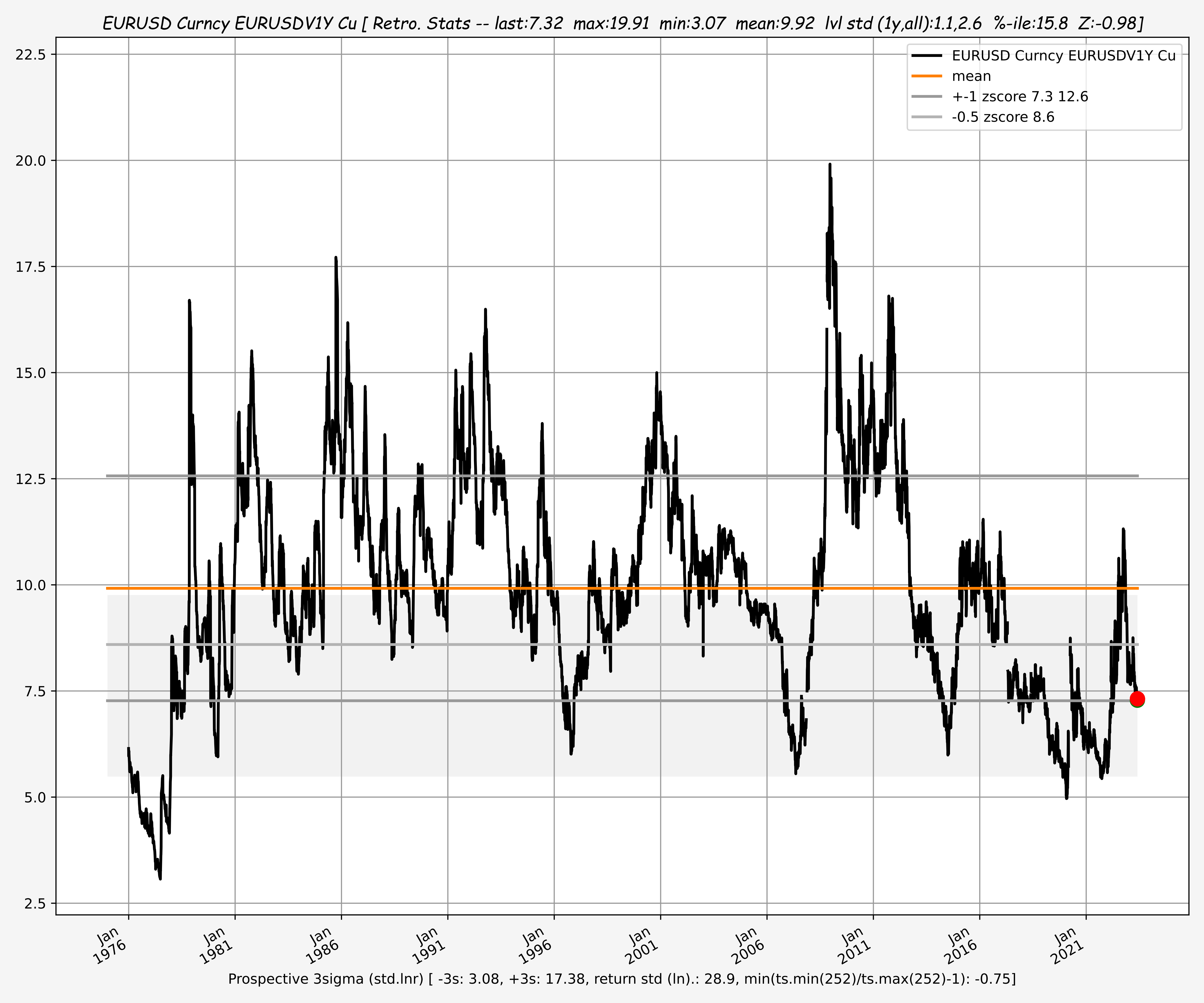
	HYG Equity
count	4041.000
mean	87.288
std	6.797
min	63.400
25%	84.810
50%	87.270
75%	91.350
max	106.090

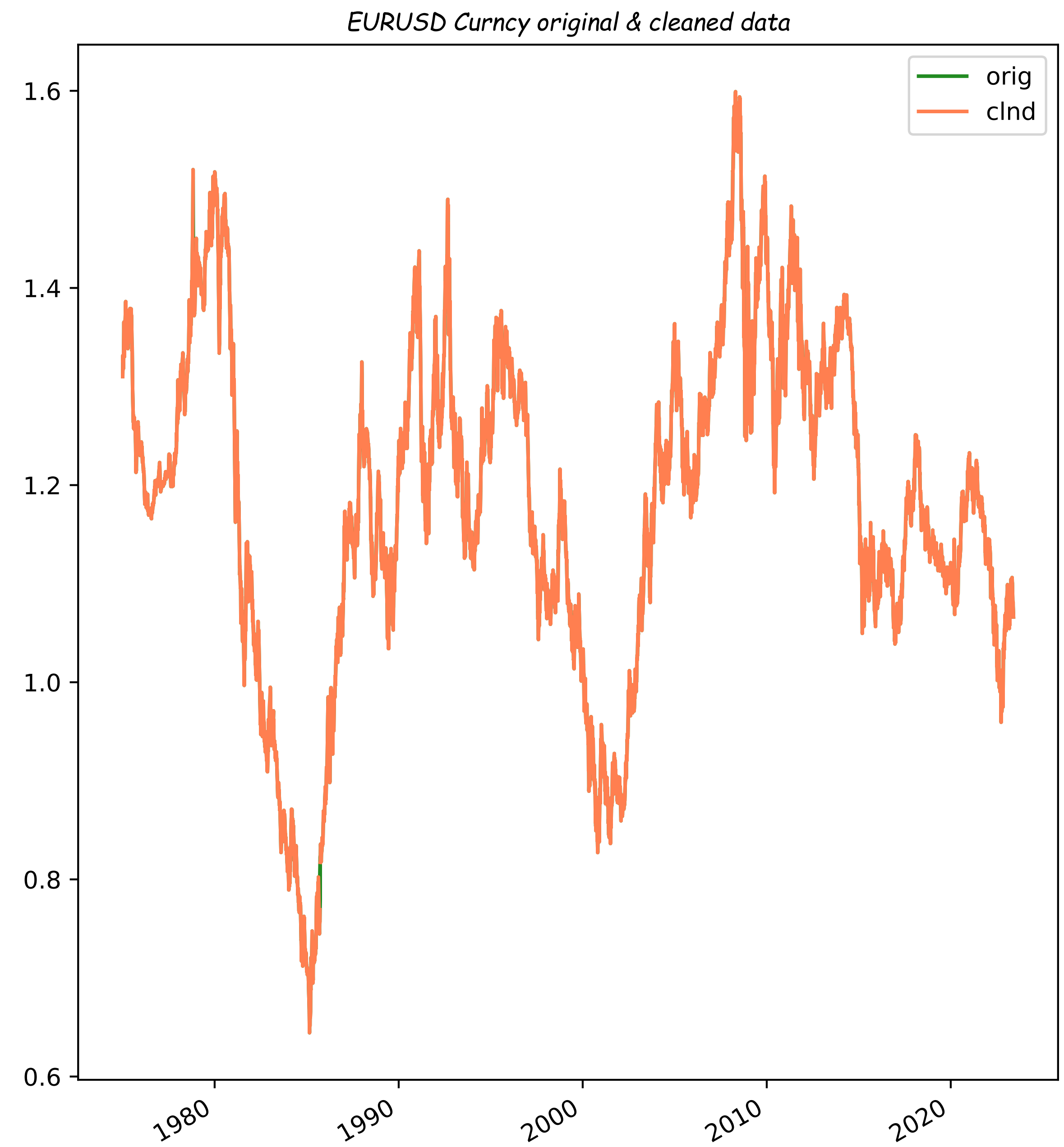
	12MTH_IMPVOL
count	3812.000
mean	9.853
std	3.089
min	6.229
25%	7.733
50%	8.978
75%	10.703
max	23.919

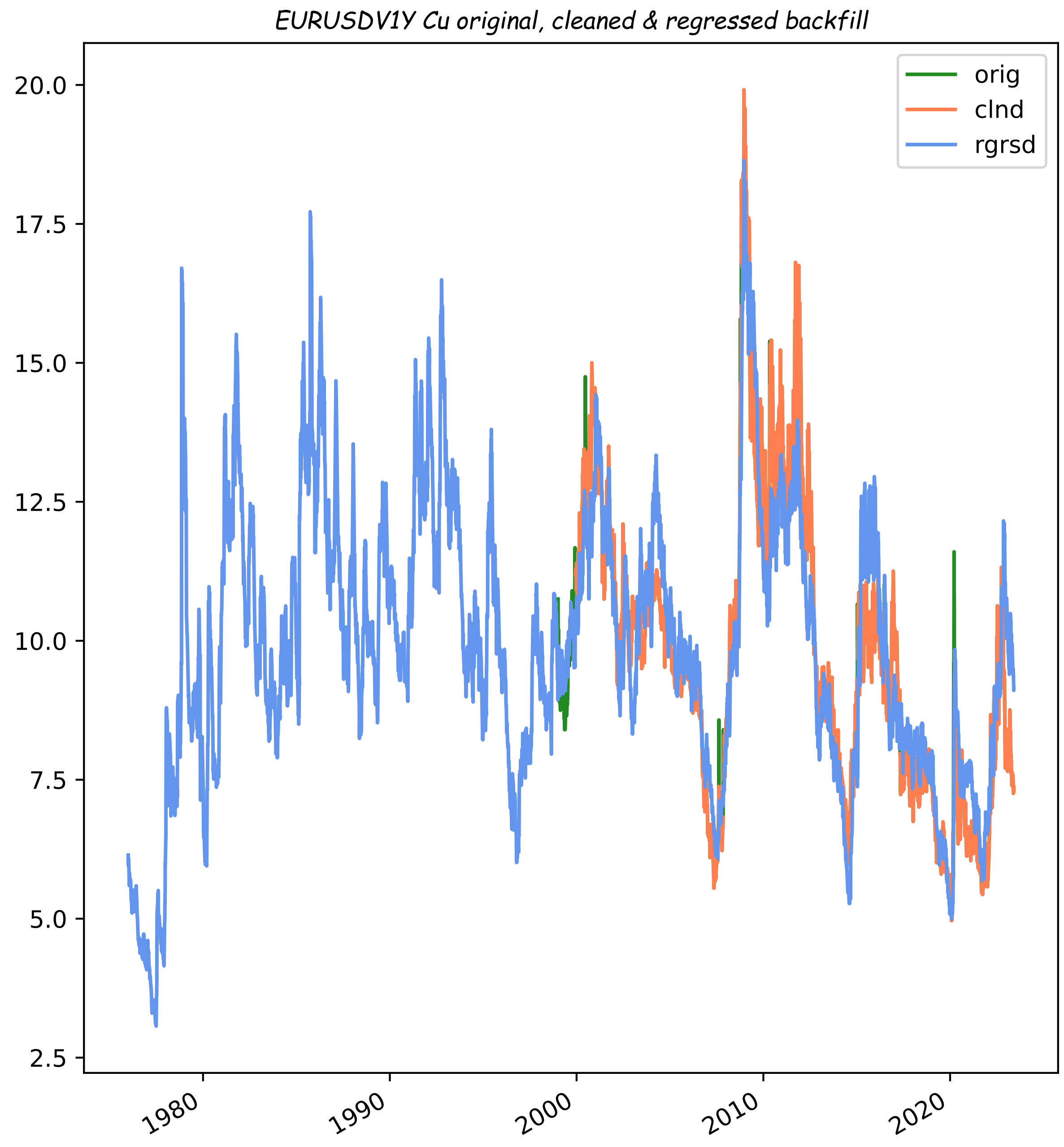
```
                                 OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.981
Model:                            OLS   Adj. R-squared (uncentered):              0.981
Method:                 Least Squares   F-statistic:                          2.477e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:55   Log-Likelihood:                         -4033.6
No. Observations:                2426   AIC:                                      8077.
Df Residuals:                    2421   BIC:                                      8106.
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0539      0.001     81.161      0.000       0.053       0.055
x2             0.2987      0.009     33.136      0.000       0.281       0.316
x3             0.1378      0.011     12.617      0.000       0.116       0.159
x4             0.1290      0.008     17.142      0.000       0.114       0.144
x5             0.0458      0.011      4.024      0.000       0.023       0.068
==============================================================================
Omnibus:                      399.485   Durbin-Watson:                   0.412
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             1304.773
Skew:                           0.820   Prob(JB):                    4.70e-284
Kurtosis:                       6.196   Cond. No.                         47.2
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

ADF Test of Resids.: -9.495 {5% -2.8627, 1% -3.4331	0		0

HYG Equity Stats	Value	12MTH_IMPVOL Stats	Value
start	04-11-2007	start	04-10-2008
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	-0.291	total_return	-0.159
cagr	-0.021	cagr	-0.011
max_drawdown	-0.402	max_drawdown	-0.740
calmar	-0.052	calmar	-0.015
mtd	-0.018	mtd	-0.066
three_month	-0.007	three_month	-0.206
six_month	-0.022	six_month	-0.319
ytd	0.005	ytd	-0.219
one_year	-0.069	one_year	-0.190
three_year	-0.037	three_year	-0.135
five_year	-0.028	five_year	0.050
ten_year	-0.023	ten_year	0.005
incep	-0.021	incep	-0.011
daily_sharpe	-0.152	daily_sharpe	0.119
daily_sortino	-0.233	daily_sortino	0.228
daily_mean	-0.016	daily_mean	0.039
daily_vol	0.105	daily_vol	0.324
daily_skew	0.280	daily_skew	4.292
daily_kurt	18.625	daily_kurt	73.081
best_day	0.092	best_day	0.403
worst_day	-0.046	worst_day	-0.189
monthly_sharpe	-0.149	monthly_sharpe	0.212
monthly_sortino	-0.224	monthly_sortino	0.646
monthly_mean	-0.016	monthly_mean	0.132
monthly_vol	0.109	monthly_vol	0.624
monthly_skew	-0.254	monthly_skew	4.588
monthly_kurt	7.725	monthly_kurt	35.626
best_month	0.147	best_month	1.613
worst_month	-0.165	worst_month	-0.255
yearly_sharpe	-0.152	yearly_sharpe	-0.042
yearly_sortino	-0.204	yearly_sortino	-0.082
yearly_mean	-0.015	yearly_mean	-0.013
yearly_vol	0.095	yearly_vol	0.304
yearly_skew	-0.784	yearly_skew	0.375
yearly_kurt	1.444	yearly_kurt	-0.716
best_year	0.156	best_year	0.535
worst_year	-0.245	worst_year	-0.513
avg_drawdown	-0.063	avg_drawdown	-0.073
avg_drawdown_days	733.625	avg_drawdown_days	304.889
avg_up_month	0.018	avg_up_month	0.129
avg_down_month	-0.021	avg_down_month	-0.082
win_year_perc	0.438	win_year_perc	0.400
twelve_month_win_perc	0.464	twelve_month_win_perc	0.468


EURUSD Curncy EURUSDV1Y Cu [Retro. Stats -- last:7.32 max:19.91 min:3.07 mean:9.92 lvl std (1y,all):1.1,2.6 %-ile:15.8 Z:-0.98]
EURUSD Curncy EURUSDV1Y Cu
mean
+-1 zscore 7.3 12.6
-0.5 zscore 8.6
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
Jan 1976
Jan 1981
Jan 1986
Jan 1991
Jan 1996
Jan 2001
Jan 2006
Jan 2011
Jan 2016
Jan 2021
Prospective 3sigma (std.lnr) [-3s: 3.08, +3s: 17.38, return std (ln).: 28.9, min(ts.min(252)/ts.max(252)-1): -0.75]





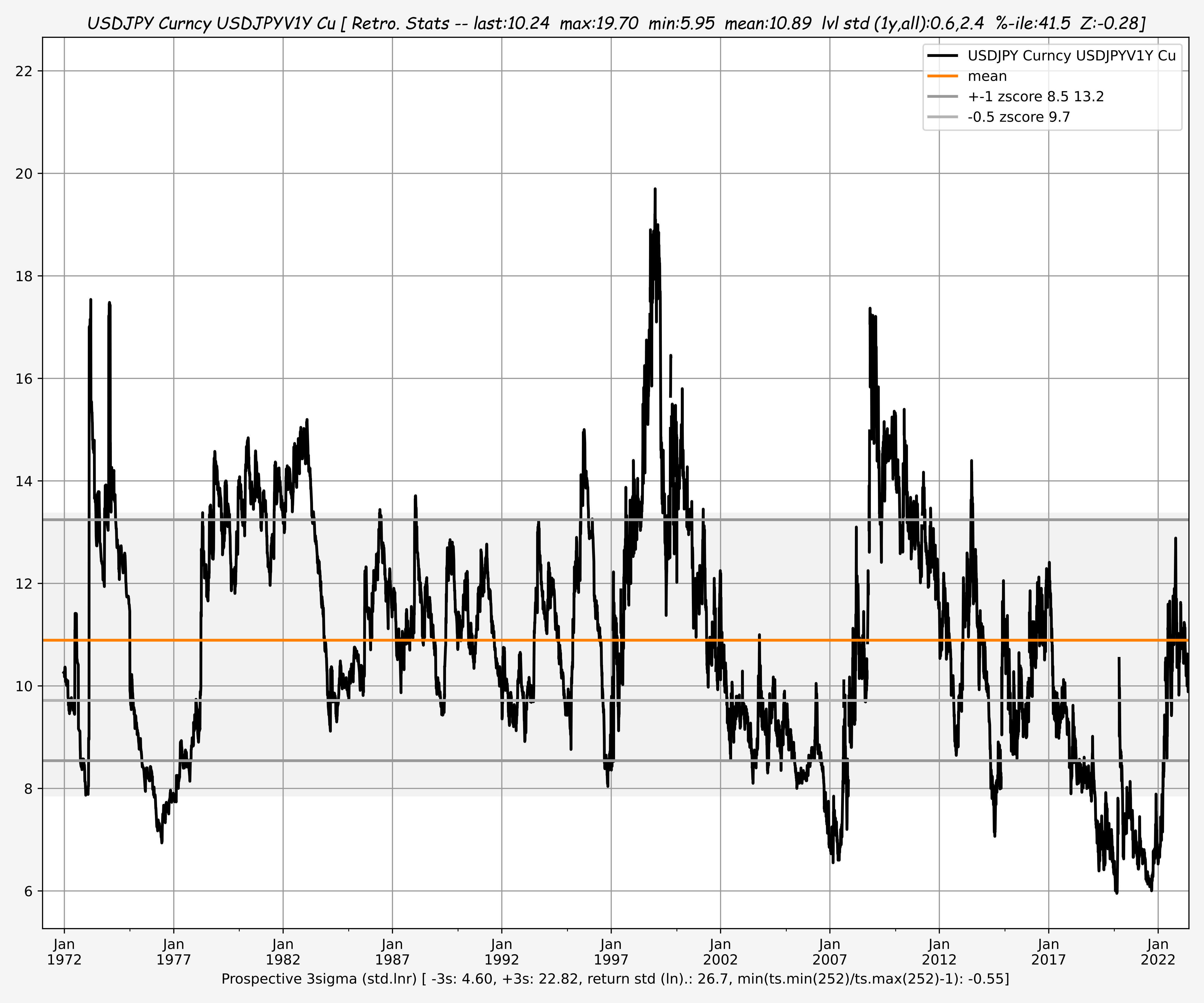
	EURUSD Curncy
count	12432.000
mean	1.181
std	0.171
min	0.644
25%	1.089
50%	1.193
75%	1.303
max	1.599

	EURUSDV1Y Cu
count	12188.000
mean	9.918
std	2.502
min	3.068
25%	8.249
50%	9.818
75%	11.648
max	18.640

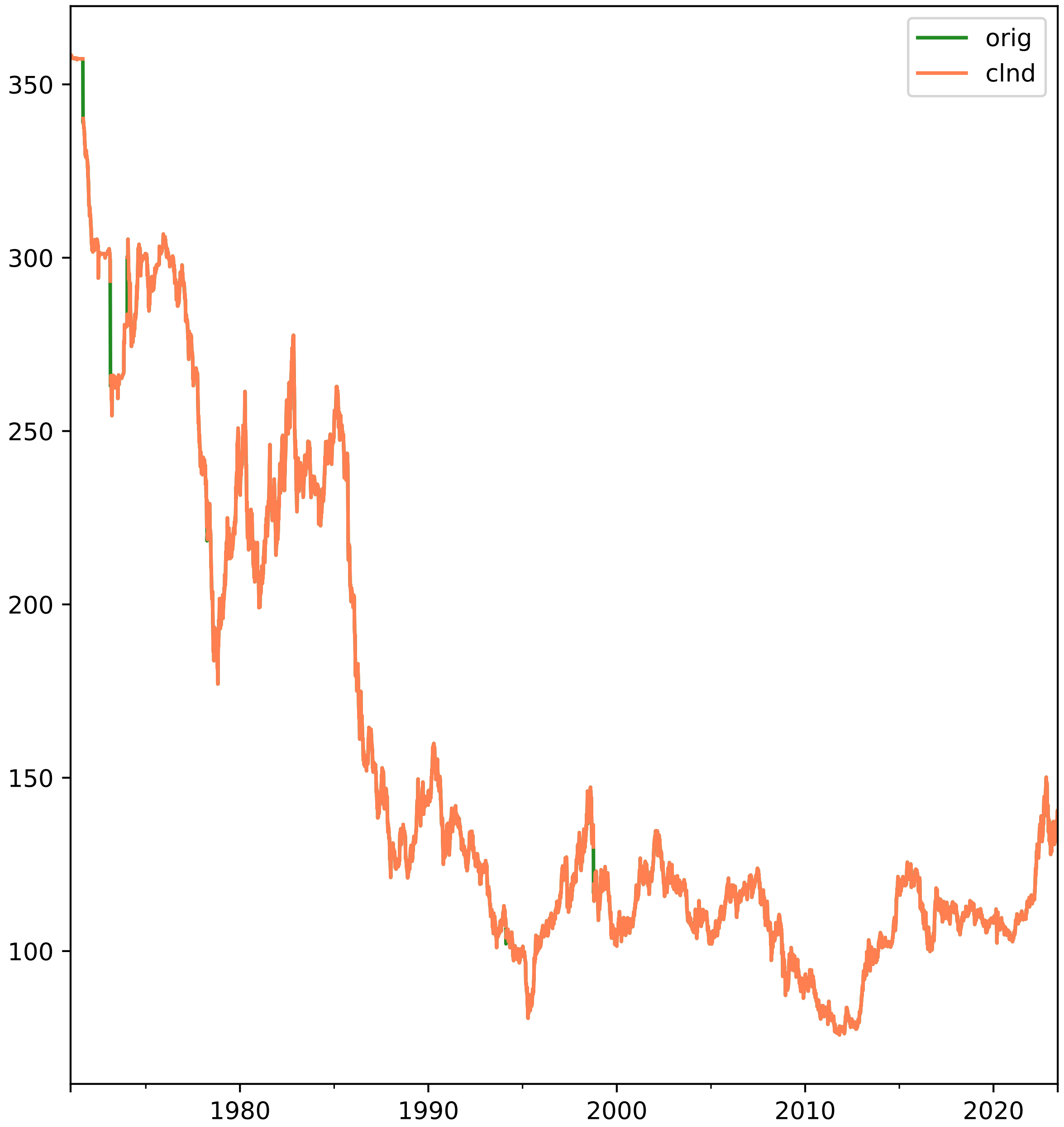
```
                                 OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.988
Model:                            OLS   Adj. R-squared (uncentered):              0.988
Method:                 Least Squares   F-statistic:                          1.044e+05
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:55:58   Log-Likelihood:                         -9209.5
No. Observations:                6116   AIC:                                  1.843e+04
Df Residuals:                    6111   BIC:                                  1.846e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.8905      0.040     22.353      0.000       0.812       0.969
x2             0.1757      0.009     18.580      0.000       0.157       0.194
x3             0.2449      0.013     19.168      0.000       0.220       0.270
x4            -0.0230      0.010     -2.190      0.029      -0.044      -0.002
x5             0.5724      0.014     41.233      0.000       0.545       0.600
==============================================================================
Omnibus:                       90.284   Durbin-Watson:                   0.034
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              120.389
Skew:                           0.199   Prob(JB):                     7.21e-27
Kurtosis:                       3.560   Cond. No.                         54.0
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

ADF Test of Resids.: -5.253 {5% -2.8620, 1% -3.4314	0

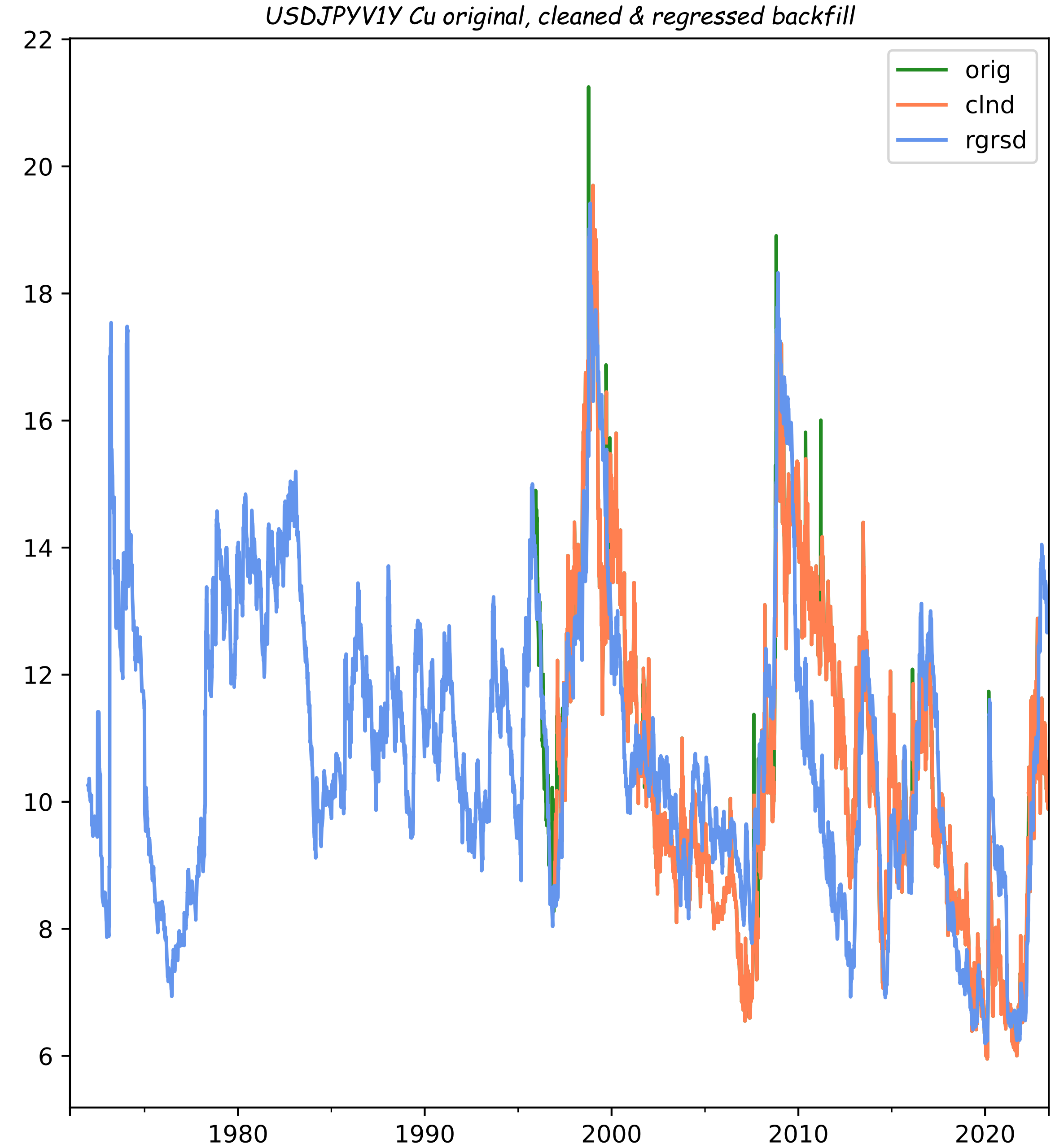
EURUSD Curncy Stats	Value	EURUSDV1Y Cu Stats	Value
start	01-02-1975	start	12-30-1975
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	-0.186	total_return	0.488
cagr	-0.004	cagr	0.008
max_drawdown	-0.576	max_drawdown	-0.732
calmar	-0.007	calmar	0.011
mtd	-0.032	mtd	-0.078
three_month	0.008	three_month	-0.036
six_month	0.025	six_month	-0.230
ytd	-0.004	ytd	-0.092
one_year	-0.007	one_year	0.018
three_year	-0.014	three_year	0.018
five_year	-0.018	five_year	0.031
ten_year	-0.020	ten_year	0.004
incep	-0.004	incep	0.008
daily_sharpe	0.004	daily_sharpe	0.157
daily_sortino	0.007	daily_sortino	0.347
daily_mean	0.000	daily_mean	0.043
daily_vol	0.096	daily_vol	0.276
daily_skew	-0.006	daily_skew	9.294
daily_kurt	4.835	daily_kurt	321.068
best_day	0.063	best_day	0.737
worst_day	-0.074	worst_day	-0.249
monthly_sharpe	0.003	monthly_sharpe	0.182
monthly_sortino	0.005	monthly_sortino	0.460
monthly_mean	0.000	monthly_mean	0.065
monthly_vol	0.101	monthly_vol	0.358
monthly_skew	-0.060	monthly_skew	2.342
monthly_kurt	0.907	monthly_kurt	10.677
best_month	0.101	best_month	0.690
worst_month	-0.106	worst_month	-0.241
yearly_sharpe	0.026	yearly_sharpe	0.158
yearly_sortino	0.055	yearly_sortino	0.432
yearly_mean	0.003	yearly_mean	0.053
yearly_vol	0.112	yearly_vol	0.337
yearly_skew	0.466	yearly_skew	1.567
yearly_kurt	-0.706	yearly_kurt	3.308
best_year	0.251	best_year	1.180
worst_year	-0.168	worst_year	-0.438
avg_drawdown	-0.079	avg_drawdown	-0.207
avg_drawdown_days	1101.562	avg_drawdown_days	1234.429
avg_up_month	0.022	avg_up_month	0.084
avg_down_month	-0.022	avg_down_month	-0.058
win_year_perc	0.438	win_year_perc	0.500
twelve_month_win_perc	0.482	twelve_month_win_perc	0.469


USDJPY Curncy USDJPYV1Y Cu [Retro. Stats -- last:10.24 max:19.70 min:5.95 mean:10.89 lvl std (1y,all):0.6,2.4 %-ile:41.5 Z:-0.28]
USDJPY Curncy USDJPYV1Y Cu
mean
+-1 zscore 8.5 13.2
-0.5 zscore 9.7
22
20
18
16
14
12
10
8
6
Jan 1972
Jan 1977
Jan 1982
Jan 1987
Jan 1992
Jan 1997
Jan 2002
Jan 2007
Jan 2012
Jan 2017
Jan 2022
Prospective 3sigma (std.lnr) [-3s: 4.60, +3s: 22.82, return std (ln).: 26.7, min(ts.min(252)/ts.max(252)-1): -0.55]

USDJPY Curncy original & cleaned data



USDJPYV1Y Cu original, cleaned & regressed backfill



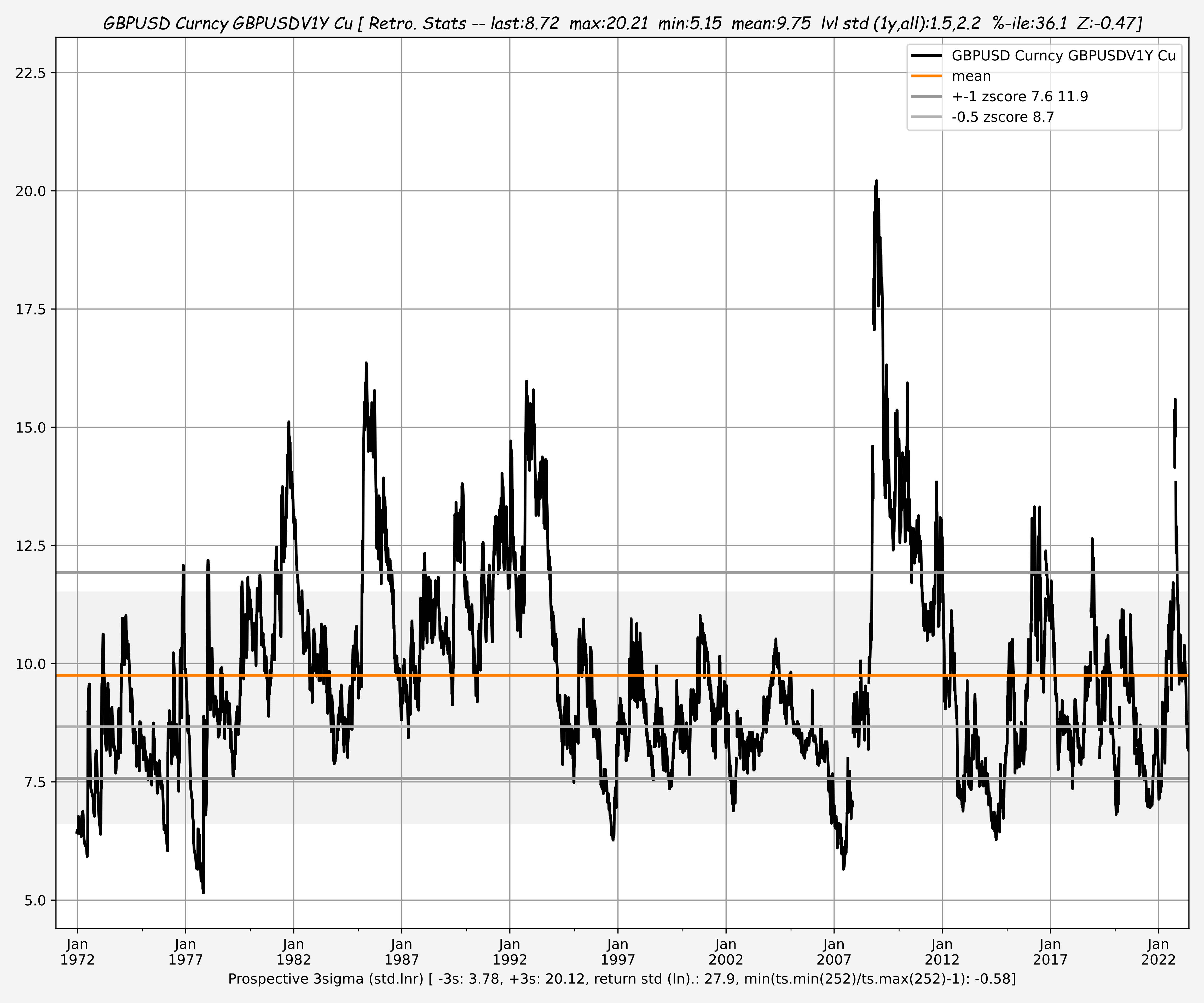
	USDJPY Curncy
count	13647.000
mean	156.657
std	71.073
min	75.820
25%	108.150
50%	121.660
75%	216.500
max	358.440

	USDJPYV1Y Cu
count	13421.000
mean	10.842
std	2.302
min	6.194
25%	9.274
50%	10.611
75%	12.316
max	19.419

```
                            OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.980
Model:                            OLS   Adj. R-squared (uncentered):              0.980
Method:                 Least Squares   F-statistic:                          6.882e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:56:01   Log-Likelihood:                         -12589.
No. Observations:                6878   AIC:                                  2.519e+04
Df Residuals:                    6873   BIC:                                  2.522e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             0.0170      0.001     31.652      0.000       0.016       0.018
x2             0.0852      0.008     11.267      0.000       0.070       0.100
x3             0.1268      0.011     11.858      0.000       0.106       0.148
x4             0.0335      0.009      3.727      0.000       0.016       0.051
x5             0.6241      0.013     46.951      0.000       0.598       0.650
==============================================================================
Omnibus:                      129.348   Durbin-Watson:                   0.023
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              125.457
Skew:                           0.299   Prob(JB):                     5.72e-28
Kurtosis:                       2.718   Cond. No.                         98.7
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

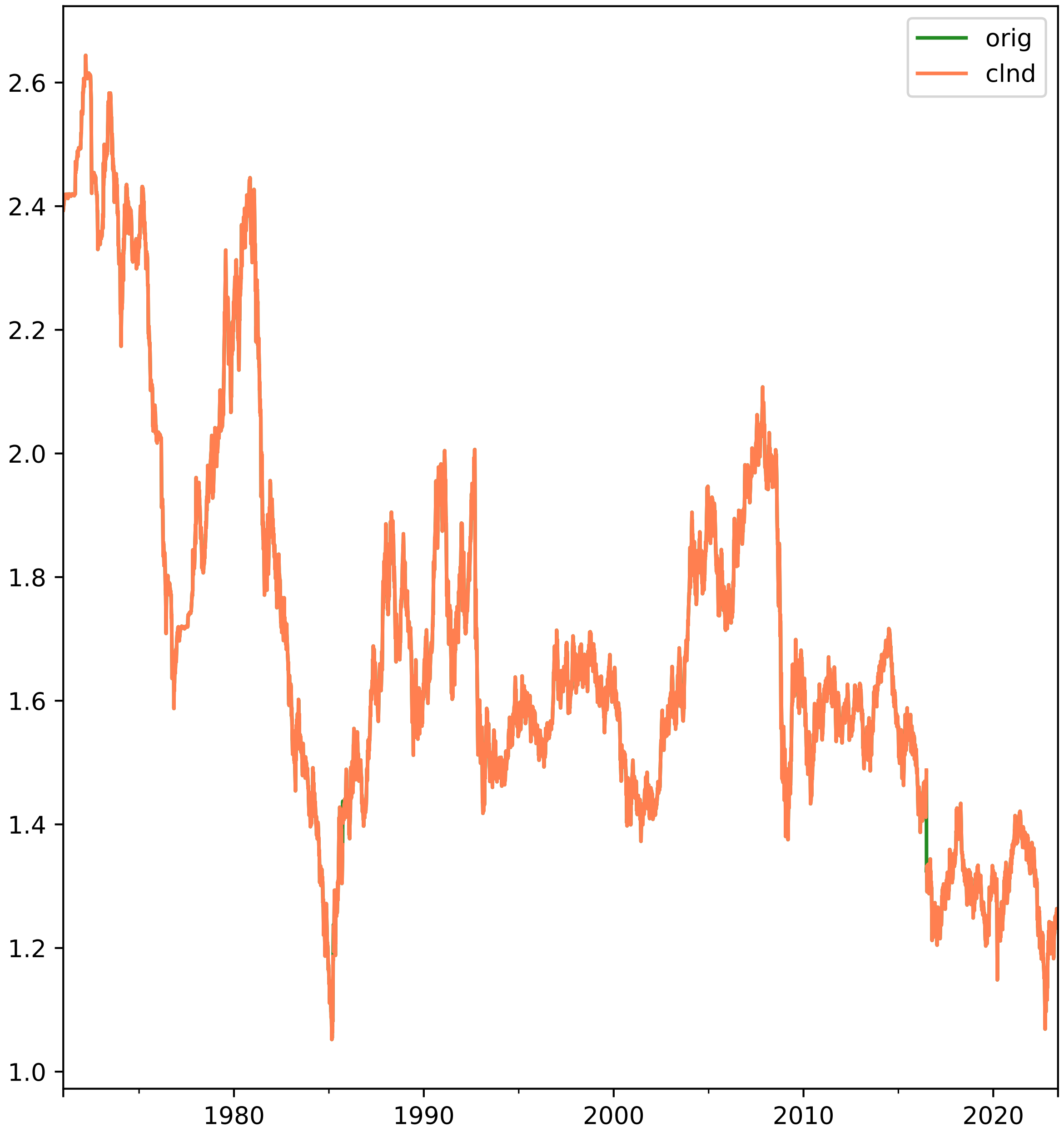
ADF Test of Resids: -4.047 [5% -2.8620, 1% -3.4313

	0		0
USDJPY Curncy Stats	Value	USDJPYV1Y Cu Stats	Value
start	01-04-1971	start	12-22-1971
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	-0.609	total_return	0.251
cagr	-0.018	cagr	0.004
max_drawdown	-0.788	max_drawdown	-0.681
calmar	-0.023	calmar	0.006
mtd	0.025	mtd	-0.014
three_month	0.026	three_month	-0.054
six_month	0.012	six_month	0.036
ytd	0.066	ytd	-0.067
one_year	0.086	one_year	0.473
three_year	0.091	three_year	0.090
five_year	0.051	five_year	0.104
ten_year	0.034	ten_year	0.014
incep	-0.018	incep	0.004
daily_sharpe	-0.124	daily_sharpe	0.109
daily_sortino	-0.190	daily_sortino	0.280
daily_mean	-0.012	daily_mean	0.023
daily_vol	0.100	daily_vol	0.208
daily_skew	-0.562	daily_skew	25.886
daily_kurt	12.331	daily_kurt	1624.267
best_day	0.068	best_day	0.888
worst_day	-0.100	worst_day	-0.152
monthly_sharpe	-0.111	monthly_sharpe	0.131
monthly_sortino	-0.172	monthly_sortino	0.376
monthly_mean	-0.012	monthly_mean	0.037
monthly_vol	0.108	monthly_vol	0.283
monthly_skew	-0.349	monthly_skew	5.681
monthly_kurt	1.837	monthly_kurt	67.952
best_month	0.109	best_month	1.156
worst_month	-0.150	worst_month	-0.193
yearly_sharpe	-0.075	yearly_sharpe	0.134
yearly_sortino	-0.127	yearly_sortino	0.373
yearly_mean	-0.009	yearly_mean	0.039
yearly_vol	0.117	yearly_vol	0.293
yearly_skew	0.033	yearly_skew	1.348
yearly_kurt	-0.731	yearly_kurt	2.077
best_year	0.237	best_year	1.088
worst_year	-0.234	worst_year	-0.347
avg_drawdown	-0.394	avg_drawdown	-0.115
avg_drawdown_days	9566.500	avg_drawdown_days	1249.800
avg_up_month	0.022	avg_up_month	0.064
avg_down_month	-0.023	avg_down_month	-0.038
win_year_perc	0.442	win_year_perc	0.442
twelve_month_win_perc	0.442	twelve_month_win_perc	0.471

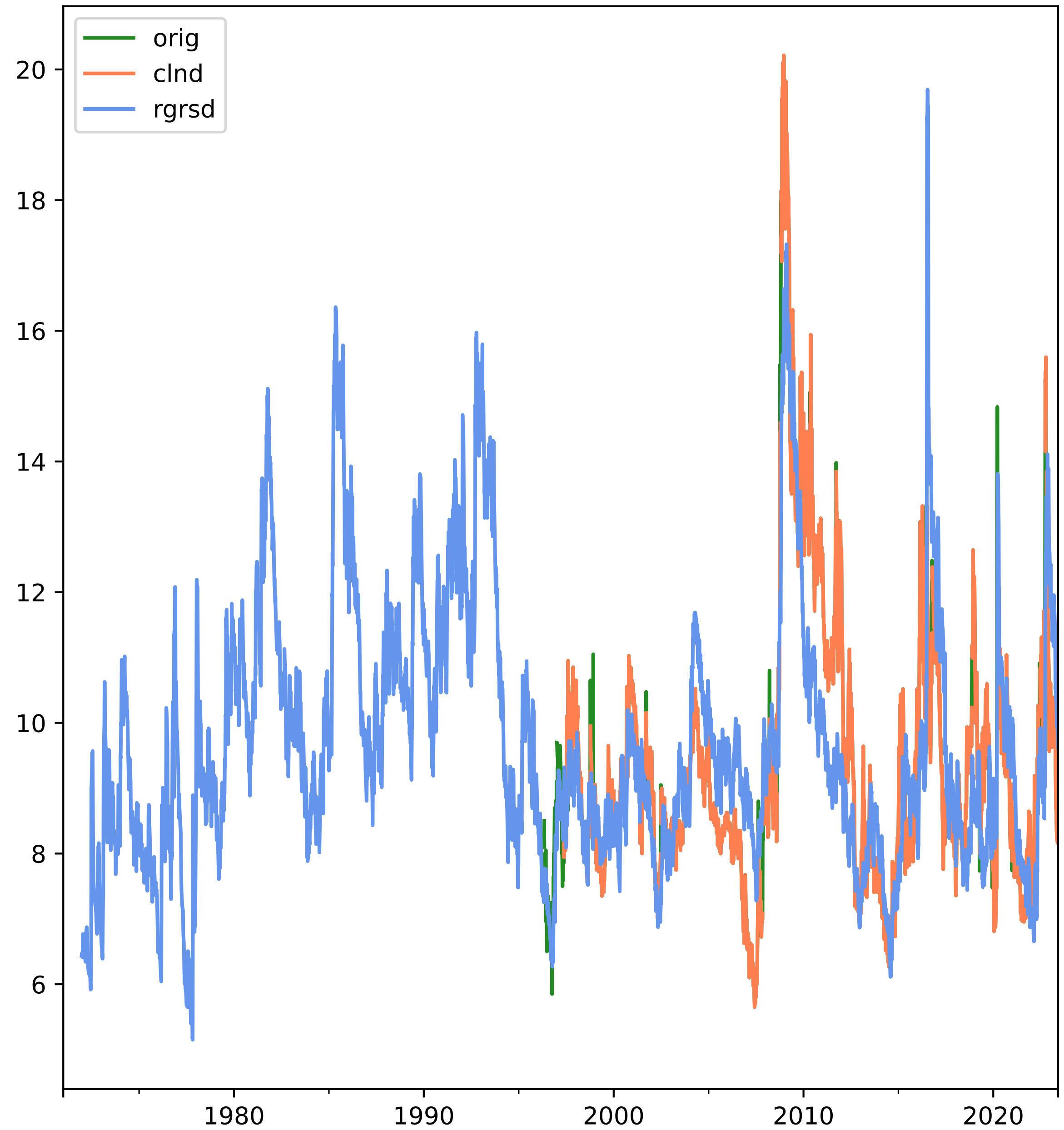


GBPUSD Curncy GBPUSDV1Y Cu [Retro. Stats -- last:8.72 max:20.21 min:5.15 mean:9.75 lvl std (1y,all):1.5,2.2 %-ile:36.1 Z:-0.47]
GBPUSD Curncy GBPUSDV1Y Cu
mean
+-1 zscore 7.6 11.9
-0.5 zscore 8.7
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
Jan 1972
Jan 1977
Jan 1982
Jan 1987
Jan 1992
Jan 1997
Jan 2002
Jan 2007
Jan 2012
Jan 2017
Jan 2022
Prospective 3sigma (std.lnr) [-3s: 3.78, +3s: 20.12, return std (ln).: 27.9, min(ts.min(252)/ts.max(252)-1): -0.58]

GBPUSD Curncy original & cleaned data



GBPUSDV1Y Cu original, cleaned & regressed backfill



	GBPUSD Curncy
count	13664.000
mean	1.696
std	0.328
min	1.052
25%	1.487
50%	1.620
75%	1.847
max	2.644

	GBPUSDV1Y Cu
count	13421.000
mean	9.726
std	2.029
min	5.150
25%	8.386
50%	9.291
75%	10.670
max	19.691

```
                                 OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.978
Model:                            OLS   Adj. R-squared (uncentered):              0.978
Method:                 Least Squares   F-statistic:                          6.116e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:56:04   Log-Likelihood:                         -11969.
No. Observations:                6762   AIC:                                  2.395e+04
Df Residuals:                    6757   BIC:                                  2.398e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1             1.7093      0.034     49.871      0.000       1.642       1.776
x2             0.1900      0.008     23.358      0.000       0.174       0.206
x3             0.1767      0.011     15.844      0.000       0.155       0.199
x4             0.0878      0.009      9.427      0.000       0.070       0.106
x5             0.3226      0.014     23.123      0.000       0.295       0.350
==============================================================================
Omnibus:                      439.757   Durbin-Watson:                   0.026
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             2024.228
Skew:                          -0.094   Prob(JB):                         0.00
Kurtosis:                       5.674   Cond. No.                         36.3
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

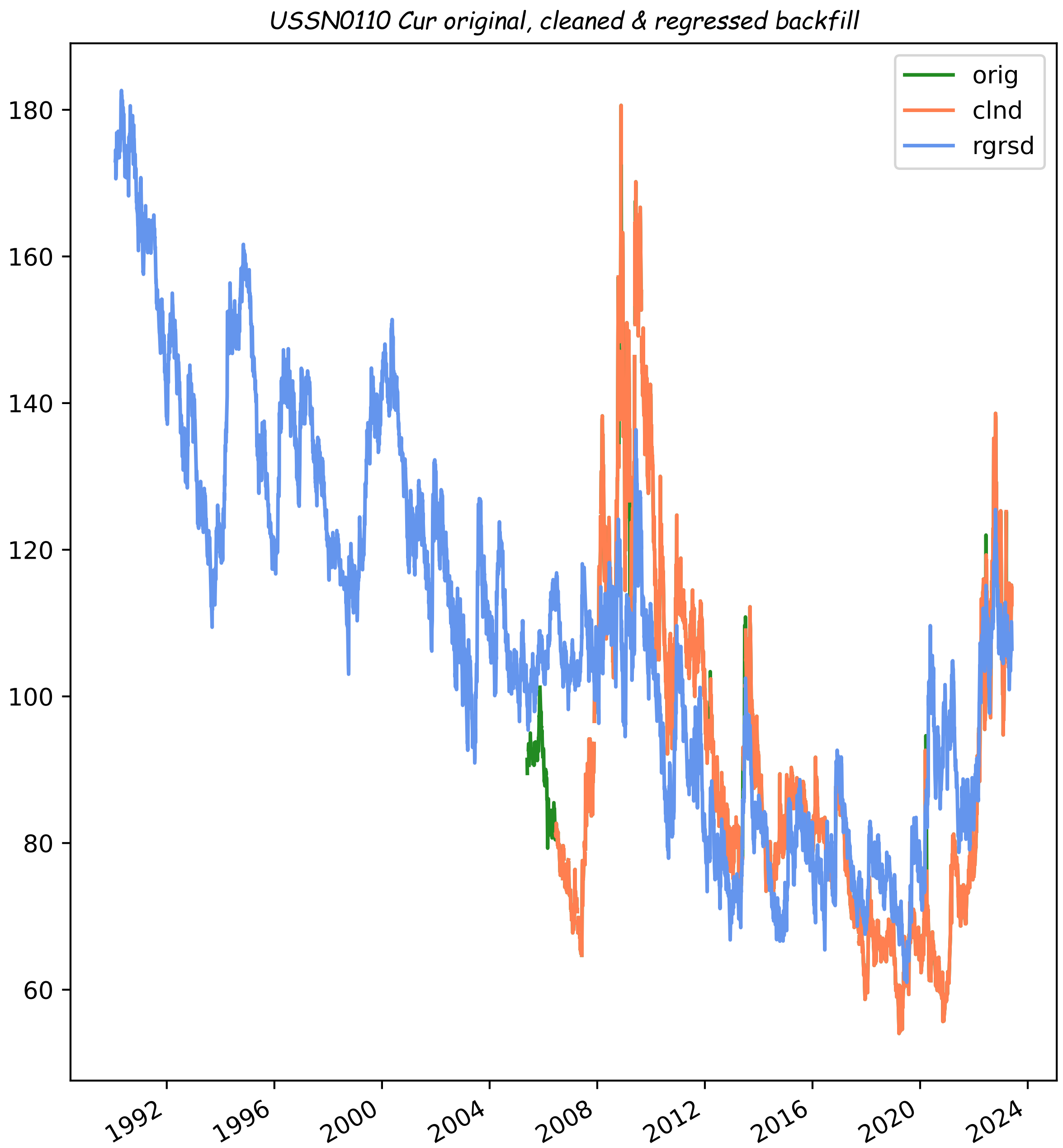
ADF Test of Resids.: -5.384 [5% -2.8620, 1% -3.4313

	0		0
GBPUSD Curncy Stats	Value	GBPUSDV1Y Cu Stats	Value
start	01-04-1971	start	12-22-1971
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	-0.482	total_return	0.495
cagr	-0.012	cagr	0.008
max_drawdown	-0.602	max_drawdown	-0.662
calmar	-0.021	calmar	0.012
mtd	-0.014	mtd	-0.071
three_month	0.031	three_month	-0.161
six_month	0.027	six_month	-0.301
ytd	0.025	ytd	-0.189
one_year	-0.017	one_year	0.045
three_year	-0.003	three_year	-0.044
five_year	-0.014	five_year	0.051
ten_year	-0.020	ten_year	0.019
incep	-0.012	incep	0.008
daily_sharpe	-0.083	daily_sharpe	0.152
daily_sortino	-0.130	daily_sortino	0.344
daily_mean	-0.008	daily_mean	0.042
daily_vol	0.094	daily_vol	0.279
daily_skew	-0.534	daily_skew	13.554
daily_kurt	10.770	daily_kurt	531.802
best_day	0.038	best_day	0.821
worst_day	-0.105	worst_day	-0.239
monthly_sharpe	-0.083	monthly_sharpe	0.173
monthly_sortino	-0.135	monthly_sortino	0.454
monthly_mean	-0.008	monthly_mean	0.062
monthly_vol	0.097	monthly_vol	0.358
monthly_skew	-0.052	monthly_skew	3.341
monthly_kurt	2.080	monthly_kurt	23.690
best_month	0.146	best_month	1.076
worst_month	-0.123	worst_month	-0.231
yearly_sharpe	-0.066	yearly_sharpe	0.134
yearly_sortino	-0.109	yearly_sortino	0.300
yearly_mean	-0.007	yearly_mean	0.030
yearly_vol	0.113	yearly_vol	0.222
yearly_skew	0.103	yearly_skew	0.827
yearly_kurt	0.140	yearly_kurt	0.842
best_year	0.272	best_year	0.660
worst_year	-0.265	worst_year	-0.305
avg_drawdown	-0.021	avg_drawdown	-0.120
avg_drawdown_days	614.065	avg_drawdown_days	424.000
avg_up_month	0.021	avg_up_month	0.081
avg_down_month	-0.021	avg_down_month	-0.053
win_year_perc	0.462	win_year_perc	0.558
twelve_month_win_perc	0.472	twelve_month_win_perc	0.488

USSW10 Curncy USSN0110 Cur [Retro. Stats -- last:114.73 max:182.64 min:54.03 mean:109.42 lvl std (1y,all):9.3,29.3 %-ile:53.9 Z:0.18]
USSW10 Curncy USSN0110 Cur
mean
+-1 zscore 80.2 138.7
-0.5 zscore 94.8
200
180
160
140
120
100
80
60
Jan 1990
Jan 1995
Jan 2000
Jan 2005
Jan 2010
Jan 2015
Jan 2020
Prospective 3sigma (std.lnr) [-3s: 16.86, +3s: 780.62, return std (ln).: 63.9, min(ts.min(252)/ts.max(252)-1): -0.53]

USSW10 Curncy original & cleaned data

USSN0110 Cur original, cleaned & regressed backfill



	USSW10 Curncy
count	8900.000
mean	4.706
std	2.323
min	0.506
25%	2.625
50%	4.645
75%	6.525
max	10.230

	USSN0110 Cur
count	8668.000
mean	109.335
std	26.565
min	61.004
25%	85.639
50%	107.426
75%	126.676
max	182.637

```
                                 OLS Regression Results
=======================================================================================
Dep. Variable:                      y   R-squared (uncentered):                   0.967
Model:                            OLS   Adj. R-squared (uncentered):              0.967
Method:                 Least Squares   F-statistic:                          2.514e+04
Date:                Wed, 31 May 2023   Prob (F-statistic):                        0.00
Time:                        10:56:05   Log-Likelihood:                         -18312.
No. Observations:                4316   AIC:                                  3.663e+04
Df Residuals:                    4311   BIC:                                  3.667e+04
Df Model:                           5
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
x1            17.2357      0.139    124.337      0.000      16.964      17.507
x2             0.2440      0.036      6.733      0.000       0.173       0.315
x3             0.2833      0.049      5.775      0.000       0.187       0.379
x4            -0.1140      0.038     -2.993      0.003      -0.189      -0.039
x5             0.7758      0.048     16.196      0.000       0.682       0.870
==============================================================================
Omnibus:                       84.832   Durbin-Watson:                   0.012
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              100.219
Skew:                          -0.286   Prob(JB):                     1.73e-22
Kurtosis:                       3.480   Cond. No.                         41.1
==============================================================================

Notes:
[1] R² is computed without centering (uncentered) since the model does not contain a constant.
[2] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

ADF Test of Resids.: -3.149 {5% -2.8622, 1% -3.4319	0

USSW10 Curncy Stats	Value	USSN0110 Cur Stats	Value
start	01-17-1989	start	02-02-1990
end	05-31-2023	end	05-31-2023
rf	0.000	rf	0.000
total_return	-0.622	total_return	-0.385
cagr	-0.028	cagr	-0.014
max_drawdown	-0.951	max_drawdown	-0.666
calmar	-0.029	calmar	-0.022
mtd	0.069	mtd	0.041
three_month	-0.066	three_month	-0.045
six_month	0.030	six_month	-0.020
ytd	-0.042	ytd	-0.045
one_year	0.254	one_year	0.018
three_year	0.780	three_year	0.029
five_year	0.048	five_year	0.062
ten_year	0.048	ten_year	0.022
incep	-0.028	incep	-0.014
daily_sharpe	0.054	daily_sharpe	0.021
daily_sortino	0.088	daily_sortino	0.049
daily_mean	0.016	daily_mean	0.004
daily_vol	0.294	daily_vol	0.192
daily_skew	-0.101	daily_skew	2.306
daily_kurt	8.402	daily_kurt	14.342
best_day	0.130	best_day	0.156
worst_day	-0.226	worst_day	-0.072
monthly_sharpe	0.050	monthly_sharpe	0.025
monthly_sortino	0.087	monthly_sortino	0.051
monthly_mean	0.015	monthly_mean	0.005
monthly_vol	0.292	monthly_vol	0.204
monthly_skew	0.380	monthly_skew	0.859
monthly_kurt	3.536	monthly_kurt	1.902
best_month	0.361	best_month	0.254
worst_month	-0.359	worst_month	-0.168
yearly_sharpe	0.076	yearly_sharpe	-0.007
yearly_sortino	0.199	yearly_sortino	-0.013
yearly_mean	0.029	yearly_mean	-0.001
yearly_vol	0.376	yearly_vol	0.161
yearly_skew	1.856	yearly_skew	0.312
yearly_kurt	4.966	yearly_kurt	-0.694
best_year	1.427	best_year	0.346
worst_year	-0.512	worst_year	-0.253
avg_drawdown	-0.197	avg_drawdown	-0.146
avg_drawdown_days	2505.800	avg_drawdown_days	2431.000
avg_up_month	0.063	avg_up_month	0.050
avg_down_month	-0.053	avg_down_month	-0.040
win_year_perc	0.382	win_year_perc	0.485
twelve_month_win_perc	0.415	twelve_month_win_perc	0.432