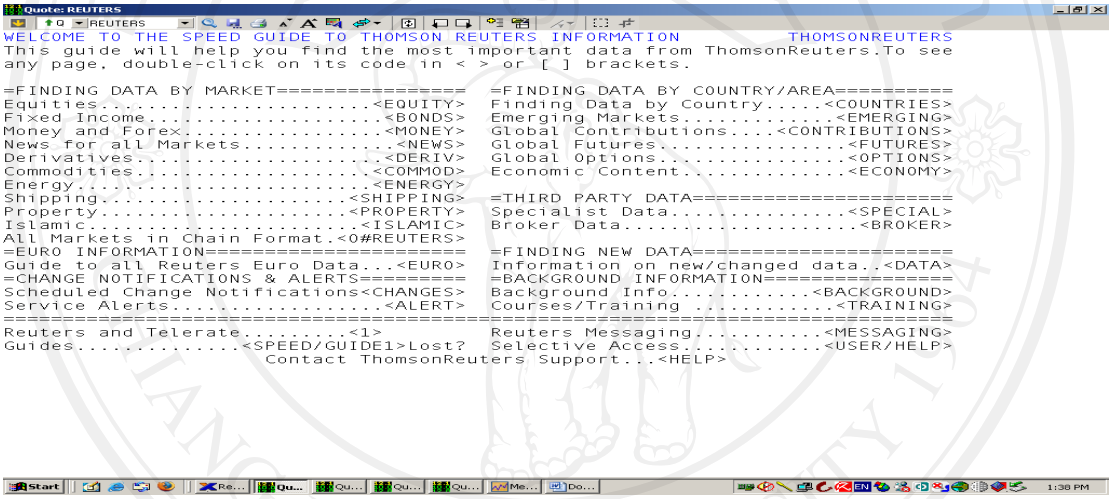
ภาคผนวก

ภาคผนวก

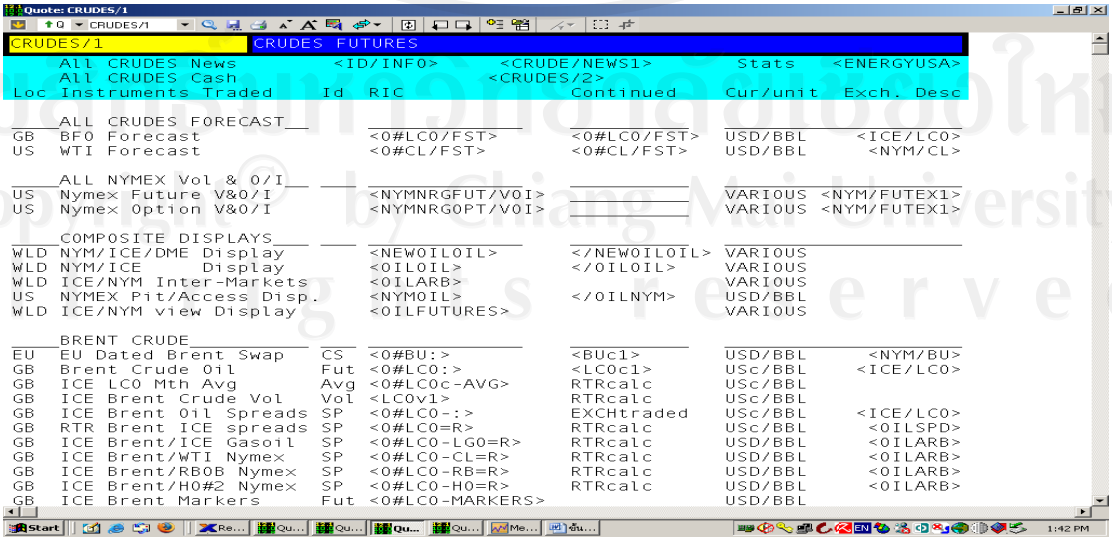
1. ขั้นตอนการค้นคว้าข้อมูลราคาน้ำมันดิบไลท์สวีทและราคาน้ำมันสำเร็จรูปเบนซิน ประกอบไปด้วย

1) เปิดโปรแกรม Reuters Kobra™ Version 3.5.1

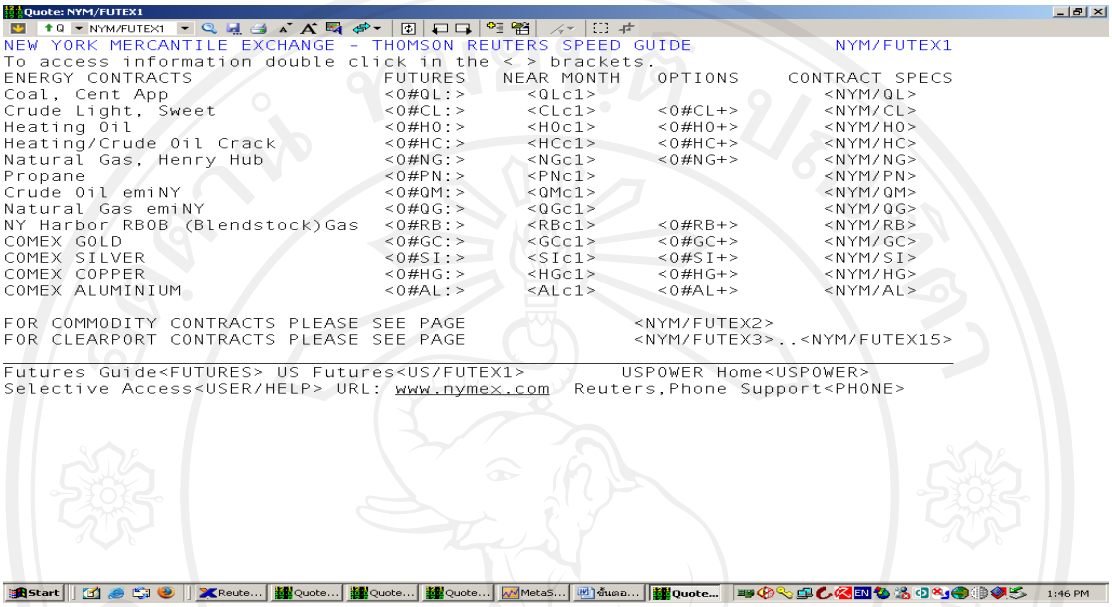
2) เมนูหน้าแรก แล้วเลือก <ENERGY>



3) เข้าสู่เมนู ENERGY แล้วเลือก <CRUDE/1> เพื่อเก็บข้อมูลราคาน้ำมันดิบไลท์สวีท

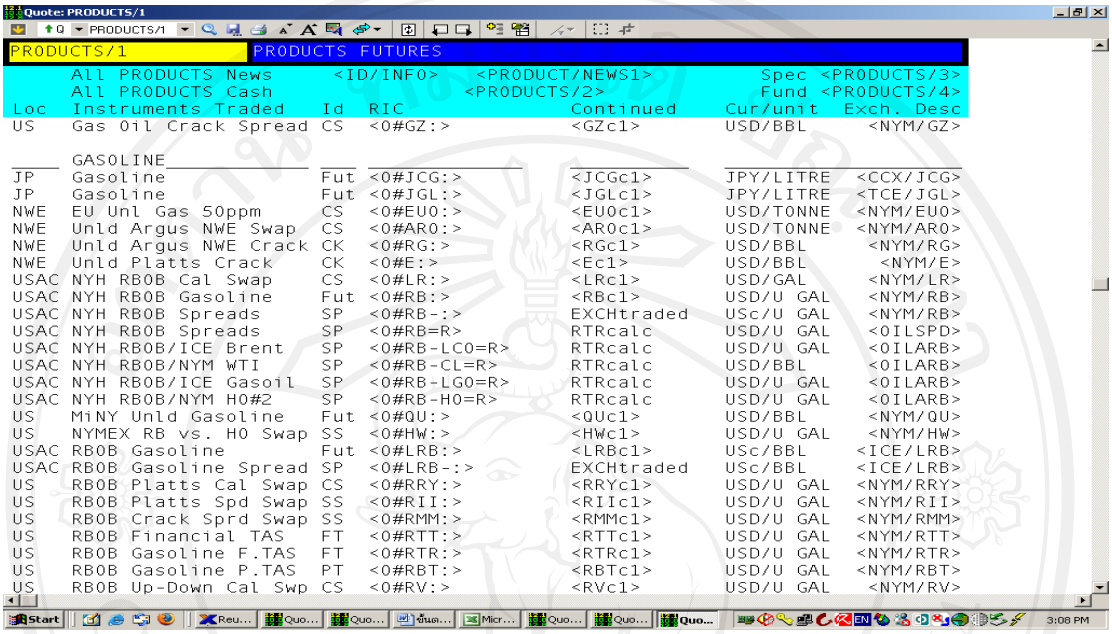


4) เข้าสู่เมนู CRUDE/1 แล้วไปที่กลุ่ม ALL NYMEX Vol O&I เลือก < NYM/FUTEX1> และเลือก <CLc1>

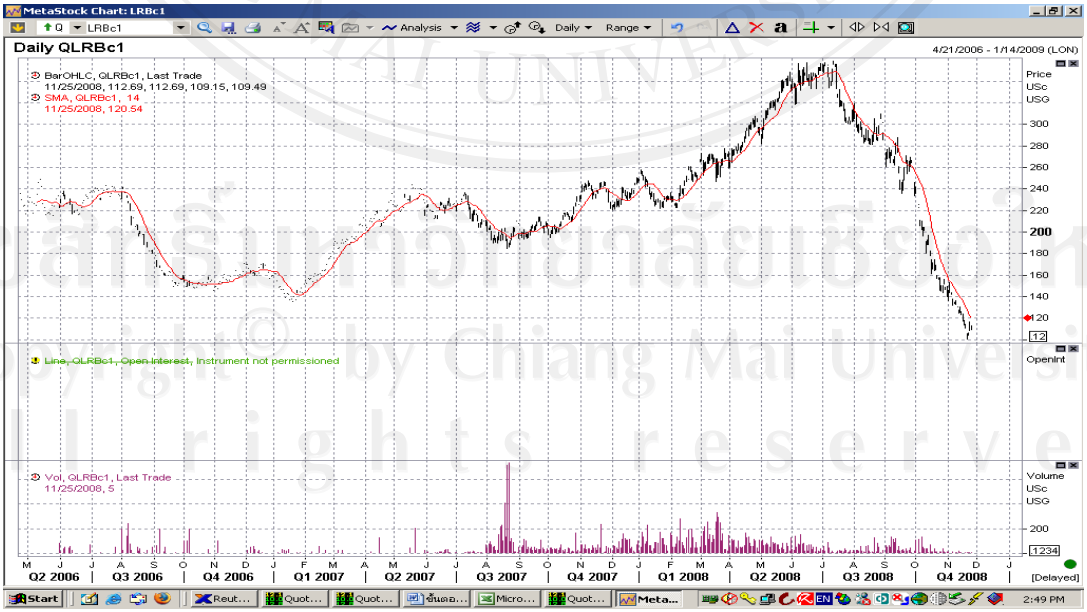


5) ปรากฏกราฟของ Daily QCLc1 หรือราคาน้ำมันดิบไลท์สวีท

6) เข้าสู่เมนู ENERGY แล้วเลือก <PRODUCTS/1> เพื่อเก็บข้อมูลราคาน้ำมันสำเร็จรูปเบนซิน



7) จากเมนู PRODUCTS/1 ไปที่กลุ่ม Gasoline แล้วเลือก <RBc1> จะได้ข้อมูลราคาน้ำมันสำเร็จรูปเบนซิน



2. ผลการ Run S-PLUS Program ข้อมูลราคาน้ำมันดิบไลท์สวีท

```
> lncl.df <- log(CLNYMEX[, 2])
> summary(lncl.df)
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
 2.343727 2.926918 3.117950 3.279198 3.440418 4.978732
> plot(lncl.df, reference.grid = F, main = "Rate of Return", type = "l")
> xx = acf(lncl.df)
> # R/S statistic
args(rosTest)
function(x, bandwidth = NULL, window = "bartlett", na.rm = F)
NULL
> # modified R/S test
rosTest(lncl.df)

Test for Long Memory: Modified R/S Test

Null Hypothesis: no long-term dependence

Test Statistics:

 8.6385**

 * : significant at 5% level
** : significant at 1% level

 Total Observ.: 6488
   Bandwidth : 11
> # unmodified R/S test
rosTest(lncl.df, bandwidth = 0)
```

Test for Long Memory: R/S Test

Null Hypothesis: no long-term dependence

Test Statistics:

29.8608**

* : significant at 5% level

** : significant at 1% level

Total Observ.: 6488

```
> # GPH test
args(gphTest)
function(x, spans = 1, taper = 0.1, pad = 0, detrend = F, demean = T, alpha =
      0.5, na.rm = F)
NULL
> gph.sp500 = gphTest(lncl.df, taper = 0)
> class(gph.sp500)
[1] "gphTest"
> names(gph.sp500)
[1] "d"      "n"      "na"     "n.freq"  "std.err"
> gph.sp500
```

Test for Long Memory: GPH Test

Null Hypothesis: d = 0

Test Statistics:

d 1.1425

stat 14.5208**

* : significant at 5% level

** : significant at 1% level

Total Observ.: 6488

Number of Freq: 80

> gph.sp500$std.err

[1] 0.07867879

> gph.sp500$d - 2 * gph.sp500$std.err

0.9851197

> gph.sp500$d + 2 * gph.sp500$std.err

1.299835

> # estimate FARIMA model by minimizing BIC

ndx.bic2 = FARIMA(lncl.df, p.range = c(0, 12), q.range = c(0, 12), mmax = 1)

p = 0 q = 0

p = 0 q = 1

p = 0 q = 2

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p = 11 q = 12

p = 12 q = 0

p = 12 q = 1

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p = 12 q = 4

p = 12 q = 5

```
p = 12  q = 6
p = 12  q = 7
p = 12  q = 8
p = 12  q = 9
p = 12  q = 10
p = 12  q = 11
p = 12  q = 12
> ndx.bic2$m
[1] 0
> summary(ndx.bic2)

Call:
FARIMA(x = lncl.df, p.range = c(0, 12), q.range = c(0, 12), mmax = 1)

Coefficients:
       Value Std. Error  t value Pr(>|t|)
   d  0.1142   0.0344    3.3226   0.0009
 AR(1)  0.8786   0.0364   24.1614   0.0000
 AR(2) -0.0035   0.0213   -0.1626   0.8708
 AR(3)  0.0373   0.0169    2.2069   0.0274
 AR(4)  0.0602   0.0168    3.5826   0.0003
 AR(5) -0.0562   0.0170   -3.3150   0.0009
 AR(6)  0.0221   0.0166    1.3355   0.1818
 AR(7)  0.0243   0.0166    1.4624   0.1437
 AR(8) -0.0306   0.0166   -1.8375   0.0662
 AR(9)  0.0331   0.0165    1.9986   0.0457
AR(10)  0.0325   0.0142    2.2947   0.0218

Information Criteria:
 log-likelihood       BIC
```

14928.75 -29760.97

Residual scale estimate: 0.0242

total residual

Degree of freedom: 6475 6463

BIC of all models estimated:

	q=0	q=1	q=2	q=3	q=4	q=5	q=6
p=0	-29735.36	-29734.22	-29730.25	-29725.38	-29719.47	-29725.48	-29724.34
p=1	-29738.62	-29747.22	-29739.15	-29731.00	-29722.12	-29733.05	-29726.09
p=2	-29742.60	-29748.82	-29740.57	-29733.08	-29723.78	-29735.16	-29725.42
p=3	-29740.81	-29744.91	-29736.94	-29753.73	-29744.26	-29736.10	-29726.68
p=4	-29740.16	-29743.31	-29735.73	-29754.02	-29756.89	-29748.84	-29728.87
p=5	-29750.13	-29756.64	-29748.02	-29750.97	-29752.92	-29751.76	-29740.51
p=6	-29750.46	-29757.58	-29747.91	-29743.90	-29751.79	-29738.38	-29734.50
p=7	-29749.43	-29753.59	-29744.42	-29747.73	-29747.05	-29750.53	-29734.02
p=8	-29759.91	-29756.85	-29748.34	-29739.97	-29744.13	-29742.14	-29733.62
p=9	-29760.46	-29758.12	-29749.52	-29740.97	-29746.77	-29726.50	-29731.85
p=10	-29760.97	-29753.46	-29745.43	-29743.09	-29728.83	-29733.66	-29726.45
p=11	-29758.37	-29751.79	-29743.04	-29742.35	-29737.12	-29732.08	-29714.02
p=12	-29754.68	-29748.18	-29739.74	-29732.90	-29733.26	-29727.08	-29710.31

	q=7	q=8	q=9	q=10	q=11	q=12
p=0	-29714.98	-29713.09	-29703.37	-29695.52	-29689.26	-29680.51
p=1	-29716.97	-29715.10	-29707.98	-29702.92	-29693.96	-29684.27
p=2	-29714.44	-29711.94	-29709.11	-29703.10	-29694.23	-29684.39
p=3	-29726.34	-29711.25	-29710.37	-29700.24	-29698.44	-29683.63
p=4	-29734.11	-29725.39	-29707.22	-29698.09	-29699.19	-29694.00
p=5	-29727.58	-29726.34	-29731.52	-29694.80	-29699.80	-29696.68

p=6 -29720.43 -29719.65 -29701.16 -29705.71 -29697.72 -29687.05

p=7 -29727.30 -29707.37 -29708.77 -29706.04 -29693.71 -29687.85

p=8 -29724.40 -29717.43 -29711.17 -29706.38 -29694.95 -29687.25

p=9 -29716.53 -29718.94 -29711.26 -29704.81 -29691.57 -29684.92

p=10 -29713.44 -29716.43 -29699.79 -29715.96 -29714.20 -29679.11

p=11 -29705.43 -29715.54 -29707.24 -29726.38 -29688.88 -29680.92

p=12 -29751.21 -29712.40 -29704.44 -29698.20 -29685.90 -29680.38

> ndx.bic2 = FARIMA(lncl.df, p = 10, q = 0, mmax = 1)

> summary(ndx.bic2)

Call:

FARIMA(x = lncl.df, p = 10, q = 0, mmax = 1)

Coefficients:

	Value	Std. Error	t value	Pr(>|t|)
d	0.1141	0.0344	3.3213	0.0009
AR(1)	0.8787	0.0364	24.1657	0.0000
AR(2)	-0.0035	0.0213	-0.1628	0.8707
AR(3)	0.0373	0.0169	2.2033	0.0276
AR(4)	0.0603	0.0168	3.5887	0.0003
AR(5)	-0.0563	0.0170	-3.3197	0.0009
AR(6)	0.0221	0.0165	1.3365	0.1814
AR(7)	0.0243	0.0166	1.4635	0.1434
AR(8)	-0.0306	0.0166	-1.8393	0.0659
AR(9)	0.0331	0.0165	2.0004	0.0455
AR(10)	0.0325	0.0142	2.2934	0.0219

Information Criteria:

log-likelihood	BIC
14934.22	-29771.90

Residual scale estimate: 0.0242

total residual

Degree of freedom: 6477 6465

> args(predict.FARIMA)

function(x, n.predict = 1, ar.approx = 50, kapprox = 100000, series = NULL)

NULL

> ndx.predlntw = predict(ndx.bic2, n.predict = 30)

> class(ndx.predlntw)

[1] "forecast"

> names(ndx.predlntw)

[1] "values" "std.err" "coef"

> summary(ndx.predlntw)

Predicted Values with Standard Errors:

	prediction	std.err
1-step-ahead	3.7226	0.0242
2-step-ahead	3.7261	0.0341
3-step-ahead	3.7272	0.0417
4-step-ahead	3.7295	0.0480
5-step-ahead	3.7350	0.0535
6-step-ahead	3.7364	0.0585
7-step-ahead	3.7352	0.0631
8-step-ahead	3.7340	0.0673
9-step-ahead	3.7335	0.0713
10-step-ahead	3.7327	0.0751
11-step-ahead	3.7317	0.0787
12-step-ahead	3.7311	0.0822

13-step-ahead 3.7308 0.0855

14-step-ahead 3.7304 0.0887

15-step-ahead 3.7304 0.0918

16-step-ahead 3.7303 0.0948

17-step-ahead 3.7300 0.0977

18-step-ahead 3.7297 0.1005

19-step-ahead 3.7295 0.1032

20-step-ahead 3.7293 0.1059

21-step-ahead 3.7292 0.1085

22-step-ahead 3.7292 0.1110

23-step-ahead 3.7294 0.1135

prediction std.err

24-step-ahead 3.7292 0.1160

25-step-ahead 3.7290 0.1183

26-step-ahead 3.7290 0.1207

27-step-ahead 3.7288 0.1230

28-step-ahead 3.7286 0.1253

29-step-ahead 3.7284 0.1275

30-step-ahead 3.7279 0.1297

> plot(ndx.predlntw, lncl.df, n.old = 200, main = "daily Taiwan Stockdgas")

3. ผลการ Run S-PLUS Program ข้อมูลราคาน้ำมันสำเร็จรูปเบนซิน

> gaso.df <- log(Gasoline[, 2])

> summary(gaso.df)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
-0.2323104	0.4831357	0.7356076	0.6994418	0.8641339	1.2728457

> plot(gaso.df, reference.grid = F, main = "Rate of Return", type = "l")

> xx = acf(gaso.df)

> # R/S statistic

```
args(rosTest)
function(x, bandwidth = NULL, window = "bartlett", na.rm = F)
NULL
> # modified R/S test
rosTest(gaso.df)

Test for Long Memory: Modified R/S Test

Null Hypothesis: no long-term dependence

Test Statistics:

 3.8337**

 * : significant at 5% level
** : significant at 1% level

 Total Observ.: 838
   Bandwidth : 6
> # unmodified R/S test
rosTest(gaso.df, bandwidth = 0)

Test for Long Memory: R/S Test

Null Hypothesis: no long-term dependence

Test Statistics:

 10.06**
```

```
 * : significant at 5% level
** : significant at 1% level

 Total Observ.: 838
> # GPH test
args(gphTest)
function(x, spans = 1, taper = 0.1, pad = 0, detrend = F, demean = T, alpha =
          0.5, na.rm = F)
NULL
> gph.sp500 = gphTest(gaso.df, taper = 0)
> class(gph.sp500)
[1] "gphTest"
> names(gph.sp500)
[1] "d"      "n"      "na"     "n.freq"  "std.err"
> gph.sp500
Test for Long Memory: GPH Test

Null Hypothesis: d = 0

Test Statistics:

  d 1.272
stat 8.6991**

 * : significant at 5% level
** : significant at 1% level

 Total Observ.: 838
Number of Freq: 28
> gph.sp500$std.err
```

```
[1] 0.1462231
> gph.sp500$d - 2 * gph.sp500$std.err

 0.9795691
> gph.sp500$d + 2 * gph.sp500$std.err

 1.564462
> # estimate FARIMA model by minimizing BIC
ndx.bic2 = FARIMA(gaso.df, p.range = c(0, 12), q.range = c(0, 12), mmax = 1)
p = 0  q = 0
p = 0  q = 1
p = 0  q = 2
p = 0  q = 3
p = 0  q = 4
p = 0  q = 5
p = 0  q = 6
p = 0  q = 7
p = 0  q = 8
p = 0  q = 9
p = 0  q = 10
p = 0  q = 11
p = 0  q = 12
p = 1  q = 0
p = 1  q = 1
p = 1  q = 2
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p = 12 q = 10

p = 12 q = 11

p = 12 q = 12

> ndx.bic2$m

[1] 1

```
> summary(ndx.bic2)

Call:

FARIMA(x = gaso.df, p.range = c(0, 12), q.range = c(0, 12), mmax = 1)


Coefficients:

        Value Std. Error  t value Pr(>|t|)
    d  0.5333   0.3200     1.6664  0.0960
 AR(1)  0.0418   0.0765     0.5465  0.5849
 AR(2) -0.1866   0.0651    -2.8667  0.0043
 AR(3) -0.4852   0.0730    -6.6447  0.0000
 AR(4)  0.8548   0.0552    15.4732  0.0000
 AR(5)  0.1362   0.0543     2.5062  0.0124
 AR(6)  0.0178   0.0526     0.3384  0.7351
 AR(7)  0.0369   0.0515     0.7152  0.4747
 AR(8) -0.7228   0.0486   -14.8821  0.0000
 AR(9)  0.4245   0.0587     7.2309  0.0000
AR(10) -0.0043   0.0635    -0.0683  0.9456
AR(11)  0.0612   0.0633     0.9666  0.3340
AR(12)  0.6915   0.0573    12.0696  0.0000
 MA(1) -0.4402   0.2982    -1.4766  0.1402
 MA(2) -0.5836   0.1030    -5.6680  0.0000
 MA(3) -1.0210   0.1591    -6.4174  0.0000
 MA(4)  0.2751   0.3646     0.7545  0.4508
 MA(5)  0.1745   0.1655     1.0542  0.2921
 MA(6) -0.0024   0.1080    -0.0219  0.9825
 MA(7)  0.0898   0.1176     0.7634  0.4454
 MA(8) -0.6874   0.1011    -6.7969  0.0000
 MA(9)  0.0227   0.2350     0.0966  0.9231
MA(10) -0.3515   0.1287    -2.7305  0.0065
        Value Std. Error  t value Pr(>|t|)
```

MA(11) -0.2307 0.1806 -1.2768 0.2020

MA(12) 0.4681 0.1849 2.5318 0.0115

Information Criteria:

log-likelihood BIC

1893.250 -3618.616

Residual scale estimate: 0.0252

total residual

Degree of freedom: 825 799

BIC of all models estimated:

	q=0	q=1	q=2	q=3	q=4	q=5	q=6
p=0	-3511.915	-3503.616	-3497.642	-3490.774	-3484.391	-3481.533	-3477.451
p=1	-3510.188	-3505.818	-3499.237	-3494.511	-3489.128	-3487.489	-3484.154
p=2	-3508.681	-3508.310	-3501.464	-3492.466	-3489.158	-3484.212	-3482.109
p=3	-3507.946	-3513.481	-3510.342	-3504.550	-3492.372	-3483.826	-3480.050
p=4	-3505.975	-3510.059	-3501.190	-3495.865	-3495.425	-3489.965	-3484.509
p=5	-3503.200	-3506.106	-3496.397	-3499.195	-3496.910	-3488.802	-3478.882
p=6	-3503.296	-3504.941	-3504.400	-3497.697	-3496.717	-3545.058	-3482.986
p=7	-3507.246	-3505.920	-3507.879	-3495.097	-3488.749	-3491.934	-3488.699
p=8	-3507.195	-3511.063	-3507.983	-3501.269	-3495.474	-3549.996	-3537.328
p=9	-3510.391	-3509.442	-3498.648	-3491.944	-3491.756	-3486.710	-3487.240
p=10	-3510.697	-3512.138	-3504.853	-3499.780	-3495.868	-3494.203	-3486.040
p=11	-3509.490	-3510.582	-3506.364	-3507.366	-3502.924	-3499.277	-3484.942
p=12	-3511.240	-3533.115	-3527.599	-3529.593	-3528.804	-3514.279	-3516.024

	q=7	q=8	q=9	q=10	q=11	q=12
p=0	-3470.091	-3464.819	-3461.586	-3460.690	-3453.981	-3446.909
p=1	-3479.396	-3471.139	-3469.798	-3466.954	-3459.849	-3452.788

```
 p=2 -3477.876 -3480.244 -3467.994 -3465.195 -3464.236 -3450.168
 p=3 -3477.968 -3470.707 -3466.639 -3468.870 -3464.768 -3458.154
 p=4 -3482.603 -3476.070 -3474.214 -3472.774 -3466.352 -3450.308
 p=5 -3481.713 -3482.315 -3470.985 -3477.234 -3468.964 -3458.002
 p=6 -3545.407 -3484.410 -3475.475 -3467.512 -3470.506 -3467.196
 p=7 -3505.886 -3534.046 -3539.156 -3475.282 -3524.272 -3452.755
 p=8 -3483.710 -3544.862 -3474.435 -3539.668 -3475.946 -3503.143
 p=9 -3481.633 -3537.499 -3476.787 -3483.355 -3474.860 -3470.656
p=10 -3488.414 -3539.999 -3476.640 -3471.135 -3476.507 -3518.052
p=11 -3486.955 -3545.397 -3538.218 -3481.674 -3520.072 -3530.762
p=12 -3535.796 -3532.065 -3500.747 -3537.816 -3524.347 -3618.616
> ndx.bic2 = FARIMA(gaso.df, p = 4, q = 1, mmax = 1)
> summary(ndx.bic2)

Call:
FARIMA(x = gaso.df, p = 4, q = 1, mmax = 1)

Coefficients:
       Value Std. Error  t value Pr(>|t|)
   d  -0.3319   0.0823    -4.0334   0.0001
AR(1)   2.2084   0.0898    24.6046   0.0000
AR(2)  -1.3830   0.1645    -8.4089   0.0000
AR(3)   0.1332   0.1003     1.3288   0.1843
AR(4)   0.0411   0.0466     0.8822   0.3779
MA(1)   0.9144   0.0166    55.1967   0.0000
Information Criteria:
 log-likelihood       BIC
  1806.511      -3572.672

Residual scale estimate: 0.0279
```

```
                total residual
Degree of freedom:   833      826
> args(predict.FARIMA)
function(x, n.predict = 1, ar.approx = 50, kapprox = 100000, series = NULL)
NULL
> ndx.predlntw = predict(ndx.bic2, n.predict = 30)
> class(ndx.predlntw)
[1] "forecast"
> names(ndx.predlntw)
[1] "values"  "std.err" "coef"
> summary(ndx.predlntw)

Predicted Values with Standard Errors:

               prediction       std.err
 1-step-ahead  1.459000e-001  2.800000e-002
 2-step-ahead  8.410000e-002  8.290000e-002
 3-step-ahead  3.100000e-002  2.522000e-001
 4-step-ahead -1.410000e-002  7.648000e-001
 5-step-ahead -5.240000e-002  2.319700e+000
 6-step-ahead -8.670000e-002  7.035700e+000
 7-step-ahead -1.169000e-001  2.133920e+001
 8-step-ahead -1.445000e-001  6.472180e+001
 9-step-ahead -1.697000e-001  1.963015e+002
10-step-ahead -1.930000e-001  5.953830e+002
11-step-ahead -2.145000e-001  1.805799e+003
12-step-ahead -2.343000e-001  5.476995e+003
13-step-ahead -2.530000e-001  1.661174e+004
14-step-ahead -2.698000e-001  5.038348e+004
```

15-step-ahead -2.850000e-001 1.528133e+005

16-step-ahead -2.991000e-001 4.634833e+005

17-step-ahead -3.113000e-001 1.405746e+006

18-step-ahead -3.226000e-001 4.263634e+006

19-step-ahead -3.328000e-001 1.293162e+007

20-step-ahead -3.424000e-001 3.922165e+007

21-step-ahead -3.507000e-001 1.189594e+008

22-step-ahead -3.588000e-001 3.608043e+008

23-step-ahead -3.654000e-001 1.094321e+009

prediction std.err

24-step-ahead -3.718000e-001 3.319079e+009

25-step-ahead -3.771000e-001 1.006678e+010

26-step-ahead -3.820000e-001 3.053257e+010

27-step-ahead -3.856000e-001 9.260541e+010

28-step-ahead -3.880000e-001 2.808726e+011

29-step-ahead -3.896000e-001 8.518875e+011

30-step-ahead -3.900000e-001 2.583778e+012

> plot(ndx.predlntw, gaso.df, n.old = 200, main = "daily Taiwan Stockdgas")

There were 32 warnings (use warnings() to see them)

4. ผลการ Run EViews 5.1 Program ข้อมูลราคาน้ำมันสำเร็จรูปเบนซิน

แบบจำลองที่เหมาะสม คือ แบบจำลอง ARIMA(4, 1, 4)

Dependent Variable: D(SER01)
Method: Least Squares
Date: 03/02/09 Time: 00:45
Sample (adjusted): 6 838
Included observations: 833 after adjustments
Convergence achieved after 52 iterations
Backcast: 2 5

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000655	0.001865	-0.351181	0.7255
AR(1)	-1.044249	0.103291	-10.10976	0.0000
AR(2)	-0.922317	0.129008	-7.149298	0.0000
AR(3)	-0.882139	0.114489	-7.705035	0.0000
AR(4)	-0.802322	0.074235	-10.80785	0.0000
MA(1)	1.013980	0.110635	9.165127	0.0000
MA(2)	0.860038	0.138611	6.204689	0.0000
MA(3)	0.782266	0.124952	6.260510	0.0000
MA(4)	0.772825	0.086744	8.909217	0.0000

R-squared	0.018972	Mean dependent var	-0.000597
Adjusted R-squared	0.009448	S.D. dependent var	0.056787
S.E. of regression	0.056518	Akaike info criterion	-2.897758
Sum squared resid	2.632122	Schwarz criterion	-2.846707
Log likelihood	1215.916	F-statistic	1.991958
Durbin-Watson stat	1.994744	Prob(F-statistic)	0.044716

Inverted AR Roots	.27-.89i	.27+.89i	-.80+.54i	-.80-.54i
Inverted MA Roots	.28-.86i	.28+.86i	-.79+.55i	-.79-.55i

หรือ เขียนในรูปแบบสมการ คือ

$$y_t = -0.0006547924512 - 1.044248679y_{t-1} - 0.9223166811y_{t-2} - 0.8821387019y_{t-3} - 0.8023224607y_{t-4} + 1.013980312e_{t-1} + 0.8600377454e_{t-2} + 0.7822657048e_{t-3} + 0.7728245174e_{t-4}$$

ประวัติผู้เขียน

ชื่อ	นางสาวฉันทิวร เทียนแป้น
วัน เดือน ปี เกิด	5 พฤศจิกายน 2521
ประวัติการศึกษา	สำเร็จการศึกษามัธยมศึกษาตอนปลาย โรงเรียนวัฒโนทัยพายัพ ปีการศึกษา 2539 สำเร็จการศึกษาปริญญาตรี วิศวกรรมศาสตรบัณฑิต สาขาอุตสาหการ มหาวิทยาลัยเชียงใหม่ ปีการศึกษา 2544
ประสบการณ์	วิศวกรอุตสาหการโรงงานอุตสหกรรมตั้งแต่ปี พ.ศ. 2545- 2549