



ภาคผนวก  
ผลการคำนวณจากโปรแกรม

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

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**ตารางที่ 1** ผลการทดสอบความนิ่งของ  $\ln(\text{GDP})_{it}$  ที่ระดับ Level

Panel unit root test: Summary

Series: LNGDP

Date: 05/10/12 Time: 18:38

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on AIC: 0 to 4

Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -2.54728  | 0.0054  | 22             | 388 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | 0.62998   | 0.7356  | 22             | 388 |
| ADF - Fisher Chi-square                                | 41.3325   | 0.5866  | 22             | 388 |
| PP - Fisher Chi-square                                 | 18.4561   | 0.9998  | 22             | 418 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

**ตารางที่ 2** ผลการทดสอบความนิ่งของ  $\ln(\text{road})_{it}$  ที่ระดับ Level

Panel unit root test: Summary

Series: LNROAD

Date: 05/10/12 Time: 18:41

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on AIC: 0 to 4

Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -4.58617  | 0.0000  | 22             | 396 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | -0.36298  | 0.3583  | 22             | 396 |
| ADF - Fisher Chi-square                                | 57.3261   | 0.0857  | 22             | 396 |
| PP - Fisher Chi-square                                 | 51.8042   | 0.1956  | 22             | 418 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

**ตารางที่ 3** ผลการทดสอบความนิ่งของ  $\ln(\text{rail})_{it}$  ที่ระดับ Level

Panel unit root test: Summary

Series: LNRAIL

Date: 05/10/12 Time: 18:51

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags  
Automatic lag length selection based on AIC: 0 to 4  
Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -6.14432  | 0.0000  | 21             | 378 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | -0.46503  | 0.3210  | 21             | 378 |
| ADF - Fisher Chi-square                                | 72.3141   | 0.0025  | 21             | 378 |
| PP - Fisher Chi-square                                 | 73.1420   | 0.0021  | 21             | 399 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

#### ตารางที่ 4 ก ผลการทดสอบความนิ่งของ $\ln(\text{roadper})_{it}$ ที่ระดับ Level

Panel unit root test: Summary  
Series: LNROADPER  
Date: 08/15/12 Time: 23:03  
Sample: 1990 2009  
Exogenous variables: Individual effects  
Automatic selection of maximum lags  
Automatic lag length selection based on SIC: 0 to 4  
Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -2.48770  | 0.0064  | 22             | 409 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | 0.27314   | 0.6076  | 22             | 409 |
| ADF - Fisher Chi-square                                | 50.0097   | 0.2470  | 22             | 409 |
| PP - Fisher Chi-square                                 | 85.6723   | 0.0002  | 22             | 418 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

#### ตารางที่ 5 ก ผลการทดสอบความนิ่งของ $\ln(\text{railper})_{it}$ ที่ระดับ Level

Panel unit root test: Summary  
Series: LNRAILPER  
Date: 08/15/12 Time: 23:04  
Sample: 1990 2009  
Exogenous variables: Individual effects  
Automatic selection of maximum lags  
Automatic lag length selection based on SIC: 0 to 4  
Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process) |           |         |                |     |

|  |          |        |    |     |
|--|----------|--------|----|-----|
| Levin, Lin & Chu t*                                    | -2.35010 | 0.0094 | 22 | 404 |
| Null: Unit root (assumes individual unit root process) |          |        |    |     |
| Im, Pesaran and Shin W-stat                            | -1.90305 | 0.0285 | 22 | 404 |
| ADF - Fisher Chi-square                                | 63.3628  | 0.0294 | 22 | 404 |
| PP - Fisher Chi-square                                 | 83.6659  | 0.0003 | 22 | 418 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

### ตารางที่ 6 ก ผลการทดสอบความนิ่งของ $\ln(\text{GDP})_{it}$ ที่ระดับ 1<sup>st</sup> Differential

Panel unit root test: Summary

Series: D(LNGDP)

Date: 07/31/12 Time: 15:27

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 2

Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -9.56916  | 0.0000  | 22             | 390 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | -7.95241  | 0.0000  | 22             | 390 |
| ADF - Fisher Chi-square                                | 161.303   | 0.0000  | 22             | 390 |
| PP - Fisher Chi-square                                 | 129.908   | 0.0000  | 22             | 396 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

### ตารางที่ 7 ก ผลการทดสอบความนิ่งของ $\ln(\text{road})_{it}$ ที่ระดับ 1<sup>st</sup> Differential

Panel unit root test: Summary

Series: D(LNROAD)

Date: 05/10/12 Time: 18:43

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on AIC: 0 to 3

Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -11.3254  | 0.0000  | 22             | 379 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | -11.3477  | 0.0000  | 22             | 379 |
| ADF - Fisher Chi-square                                | 217.097   | 0.0000  | 22             | 379 |
| PP - Fisher Chi-square                                 | 560.997   | 0.0000  | 22             | 396 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

**ตารางที่ 8 ก** ผลการทดสอบความนิ่งของ  $\ln(rail)_{it}$  ที่ระดับ 1<sup>st</sup> Differential

Panel unit root test: Summary

Series: LNRAIL

Date: 05/10/12 Time: 18:51

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on AIC: 0 to 4

Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -6.14432  | 0.0000  | 21             | 378 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | -0.46503  | 0.3210  | 21             | 378 |
| ADF - Fisher Chi-square                                | 72.3141   | 0.0025  | 21             | 378 |
| PP - Fisher Chi-square                                 | 73.1420   | 0.0021  | 21             | 399 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

**ตารางที่ 9 ก** ผลการทดสอบความนิ่งของ  $\ln(roadper)_{it}$  ที่ระดับ 1<sup>st</sup> Differential

Panel unit root test: Summary

Series: D(LNROADPER)

Date: 08/15/12 Time: 23:16

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 3

Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -13.8311  | 0.0000  | 22             | 390 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | -14.8152  | 0.0000  | 22             | 390 |
| ADF - Fisher Chi-square                                | 264.324   | 0.0000  | 22             | 390 |
| PP - Fisher Chi-square                                 | 533.695   | 0.0000  | 22             | 396 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

ตารางที่ 10 ก ผลการทดสอบความนิ่งของ  $\ln(railper)_{it}$  ที่ระดับ 1<sup>st</sup> Differential

Panel unit root test: Summary

Series: D(LNRAILPER)

Date: 08/15/12 Time: 23:22

Sample: 1990 2009

Exogenous variables: Individual effects

Automatic selection of maximum lags

Automatic lag length selection based on SIC: 0 to 3

Newey-West automatic bandwidth selection and Bartlett kernel

| Method   | Statistic | Prob.** | Cross-sections | Obs |
|--|-----------|---------|----------------|-----|
| Null: Unit root (assumes common unit root process)     |           |         |                |     |
| Levin, Lin & Chu t*                                    | -13.2661  | 0.0000  | 22             | 383 |
| Null: Unit root (assumes individual unit root process) |           |         |                |     |
| Im, Pesaran and Shin W-stat                            | -15.2256  | 0.0000  | 22             | 383 |
| ADF - Fisher Chi-square                                | 280.331   | 0.0000  | 22             | 383 |
| PP - Fisher Chi-square                                 | 862.108   | 0.0000  | 22             | 396 |

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

ตารางที่ 11 ก ผลการทดสอบพหุคูณโคอินทิเกรชันระหว่าง  $\ln(GDP)_{it}$  กับ  $\ln(road)_{it}$  ด้วยวิธี

Pedroni

Pedroni Residual Cointegration Test

Series: LNGDP LNROAD

Date: 07/13/12 Time: 10:56

Sample: 1990 2009

Included observations: 440

Cross-sections included: 22

Null Hypothesis: No cointegration

Trend assumption: Deterministic intercept and trend

Automatic lag length selection based on SIC with a max lag of 3

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

|                     | Statistic | Prob.  | Weighted<br>Statistic | Prob.  |
|---------------------|-----------|--------|-----------------------|--------|
| Panel v-Statistic   | 4.431694  | 0.0000 | 12.05183              | 0.0000 |
| Panel rho-Statistic | -0.803522 | 0.2108 | -0.161832             | 0.4357 |
| Panel PP-Statistic  | -4.949228 | 0.0000 | -1.604254             | 0.0543 |
| Panel ADF-Statistic | -5.751378 | 0.0000 | -3.263578             | 0.0006 |

Alternative hypothesis: individual AR coefs. (between-dimension)

|                     | Statistic | Prob.  |
|---------------------|-----------|--------|
| Group rho-Statistic | 1.626219  | 0.9480 |
| Group PP-Statistic  | -0.513403 | 0.3038 |
| Group ADF-Statistic | -2.967242 | 0.0015 |



ตารางที่ 12 ก ผลการทดสอบพหุสมการโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{road})_{it}$  ด้วยวิธี Kao

Kao Residual Cointegration Test  
 Series: LNGDP LNROAD  
 Date: 07/13/12 Time: 11:00  
 Sample: 1990 2009  
 Included observations: 440  
 Null Hypothesis: No cointegration  
 Trend assumption: No deterministic trend  
 Automatic lag length selection based on SIC with a max lag of 4  
 Newey-West automatic bandwidth selection and Bartlett kernel

|                   | t-Statistic | Prob.  |
|-------------------|-------------|--------|
| ADF               | -2.975916   | 0.0015 |
| Residual variance | 0.003535    |        |
| HAC variance      | 0.007317    |        |

ตารางที่ 13 ก ผลการทดสอบพหุสมการโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{road})_{it}$  ด้วยวิธี

Johansen

Johansen Fisher Panel Cointegration Test

Series: LNGDP LNROAD  
 Date: 07/13/12 Time: 11:01  
 Sample: 1990 2009  
 Included observations: 440  
 Trend assumption: Linear deterministic trend  
 Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

| Hypothesized<br>No. of CE(s) | Fisher Stat.*<br>(from trace test) | Prob.  | Fisher Stat.*<br>(from max-eigen test) | Prob.  |
|------------------------------|------------------------------------|--------|--|--------|
| None                         | 166.5                              | 0.0000 | 134.7                                  | 0.0000 |
| At most 1                    | 108.9                              | 0.0000 | 108.9                                  | 0.0000 |

\* Probabilities are computed using asymptotic Chi-square distribution.

ตารางที่ 14 ก ผลการทดสอบพหุสมการโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{rail})_{it}$  ด้วยวิธี

Pedroni

Pedroni Residual Cointegration Test

Series: LNGDP LNRAIL  
 Date: 08/15/12 Time: 23:29  
 Sample: 1990 2009  
 Included observations: 440  
 Cross-sections included: 22  
 Null Hypothesis: No cointegration  
 Trend assumption: Deterministic intercept and trend  
 Automatic lag length selection based on SIC with a max lag of 3  
 Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

|                     | Statistic | Prob.  | Weighted<br>Statistic | Prob.  |
|---------------------|-----------|--------|-----------------------|--------|
| Panel v-Statistic   | 1.135277  | 0.1281 | 8.741686              | 0.0000 |
| Panel rho-Statistic | 1.028944  | 0.8482 | 0.600920              | 0.7261 |
| Panel PP-Statistic  | -3.580822 | 0.0002 | -1.248877             | 0.1059 |
| Panel ADF-Statistic | -5.948788 | 0.0000 | -0.588433             | 0.2781 |

Alternative hypothesis: individual AR coefs. (between-dimension)

|                     | Statistic | Prob.  |
|---------------------|-----------|--------|
| Group rho-Statistic | 2.574744  | 0.9950 |
| Group PP-Statistic  | 0.911928  | 0.8191 |
| Group ADF-Statistic | 0.161605  | 0.5642 |

ตารางที่ 15 ก ผลการทดสอบพหุคูณโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{rail})_{it}$  ด้วยวิธี Kao

Kao Residual Cointegration Test  
 Series: LNGDP LNRAIL  
 Date: 08/15/12 Time: 23:38  
 Sample: 1990 2009  
 Included observations: 440  
 Null Hypothesis: No cointegration  
 Trend assumption: No deterministic trend  
 Automatic lag length selection based on SIC with a max lag of 4  
 Newey-West automatic bandwidth selection and Bartlett kernel

|                   | t-Statistic | Prob.  |
|-------------------|-------------|--------|
| ADF               | -1.226453   | 0.1100 |
| Residual variance | 0.003594    |        |
| HAC variance      | 0.008020    |        |

ตารางที่ 16 ก ผลการทดสอบพหุคูณโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{rail})_{it}$  ด้วยวิธี

Johansen

Johansen Fisher Panel Cointegration Test  
 Series: LNGDP LNRAIL  
 Date: 08/15/12 Time: 23:40  
 Sample: 1990 2009  
 Included observations: 440  
 Trend assumption: Linear deterministic trend  
 Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

| Hypothesized<br>No. of CE(s) | Fisher Stat.*<br>(from trace test) | Prob.  | Fisher Stat.*<br>(from max-eigen test) | Prob.  |
|------------------------------|------------------------------------|--------|--|--------|
| None                         | 159.1                              | 0.0000 | 130.3                                  | 0.0000 |
| At most 1                    | 108.0                              | 0.0000 | 108.0                                  | 0.0000 |

\* Probabilities are computed using asymptotic Chi-square distribution.



ตารางที่ 17 ก ผลการทดสอบพหุคูณโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{roadper})_{it}$  ด้วยวิธี

Pedroni

Pedroni Residual Cointegration Test

Series: LNGDP LNROADPER

Date: 08/15/12 Time: 23:55

Sample: 1990 2009

Included observations: 440

Cross-sections included: 22

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

Automatic lag length selection based on AIC with a max lag of 3

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

|                     | Statistic | Prob.  | Weighted<br>Statistic | Prob.  |
|---------------------|-----------|--------|-----------------------|--------|
| Panel v-Statistic   | 0.104292  | 0.4585 | -1.060073             | 0.8554 |
| Panel rho-Statistic | -0.675158 | 0.2498 | 0.368678              | 0.6438 |
| Panel PP-Statistic  | -2.565796 | 0.0051 | -0.601653             | 0.2737 |
| Panel ADF-Statistic | -3.199437 | 0.0007 | -0.979629             | 0.1636 |

Alternative hypothesis: individual AR coefs. (between-dimension)

|                     | Statistic | Prob.  |
|---------------------|-----------|--------|
| Group rho-Statistic | 0.638641  | 0.7385 |
| Group PP-Statistic  | -1.375117 | 0.0845 |
| Group ADF-Statistic | -2.931418 | 0.0017 |

ตารางที่ 18 ก ผลการทดสอบพหุคูณโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{roadper})_{it}$  ด้วยวิธี

Kao

Kao Residual Cointegration Test

Series: LNGDP LNROADPER

Date: 08/15/12 Time: 23:56

Sample: 1990 2009

Included observations: 440

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

Automatic lag length selection based on AIC with a max lag of 4

Newey-West automatic bandwidth selection and Bartlett kernel

|                   | t-Statistic | Prob.  |
|-------------------|-------------|--------|
| ADF               | -1.742008   | 0.0408 |
| Residual variance | 0.003568    |        |
| HAC variance      | 0.007663    |        |

ตารางที่ 19 ก ผลการทดสอบพหุสมการโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{roadper})_{it}$  ด้วยวิธี

Johansen

Johansen Fisher Panel Cointegration Test

Series: LNGDP LNROADPER

Date: 08/15/12 Time: 23:57

Sample: 1990 2009

Included observations: 440

Trend assumption: Linear deterministic trend

Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

| Hypothesized<br>No. of CE(s) | Fisher Stat.*<br>(from trace test) | Prob.  | Fisher Stat.*<br>(from max-eigen test) | Prob.  |
|------------------------------|------------------------------------|--------|--|--------|
| None                         | 161.3                              | 0.0000 | 133.6                                  | 0.0000 |
| At most 1                    | 105.1                              | 0.0000 | 105.1                                  | 0.0000 |

\* Probabilities are computed using asymptotic Chi-square distribution.

ตารางที่ 20 ก ผลการทดสอบพหุสมการโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{railper})_{it}$  ด้วยวิธี

Pedroni

Pedroni Residual Cointegration Test

Series: LNGDP LNRAILPER

Date: 08/16/12 Time: 00:07

Sample: 1990 2009

Included observations: 440

Cross-sections included: 22

Null Hypothesis: No cointegration

Trend assumption: No deterministic intercept or trend

Automatic lag length selection based on SIC with a max lag of 4

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

|                     | Statistic | Prob.  | Weighted<br>Statistic | Prob.  |
|---------------------|-----------|--------|-----------------------|--------|
| Panel v-Statistic   | -3.396803 | 0.9997 | -3.524539             | 0.9998 |
| Panel rho-Statistic | -1.994816 | 0.0230 | -2.231848             | 0.0128 |
| Panel PP-Statistic  | -3.079955 | 0.0010 | -3.250983             | 0.0006 |
| Panel ADF-Statistic | -2.952457 | 0.0016 | -3.104837             | 0.0010 |

Alternative hypothesis: individual AR coefs. (between-dimension)

|                     | Statistic | Prob.  |
|---------------------|-----------|--------|
| Group rho-Statistic | 0.246301  | 0.5973 |
| Group PP-Statistic  | -4.087905 | 0.0000 |
| Group ADF-Statistic | -2.470125 | 0.0068 |

ตารางที่ 21 ก ผลการทดสอบพหุคูณโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{railper})_{it}$  ด้วยวิธี

Kao

Kao Residual Cointegration Test  
 Series: LNGDP LNRAILPER  
 Date: 08/16/12 Time: 00:15  
 Sample: 1990 2009  
 Included observations: 440  
 Null Hypothesis: No cointegration  
 Trend assumption: No deterministic trend  
 Automatic lag length selection based on AIC with a max lag of 4  
 Newey-West automatic bandwidth selection and Parzen kernel

|                   | t-Statistic | Prob.  |
|-------------------|-------------|--------|
| ADF               | -1.347090   | 0.0890 |
| Residual variance | 0.003601    |        |
| HAC variance      | 0.009792    |        |

ตารางที่ 22 ก ผลการทดสอบพหุคูณโคอินทิเกรชันระหว่าง  $\ln(\text{GDP})_{it}$  กับ  $\ln(\text{railper})_{it}$  ด้วยวิธี

Johansen

Johansen Fisher Panel Cointegration Test  
 Series: LNGDP LNRAILPER  
 Date: 08/16/12 Time: 00:08  
 Sample: 1990 2009  
 Included observations: 440  
 Trend assumption: Linear deterministic trend  
 Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

| Hypothesized<br>No. of CE(s) | Fisher Stat.*<br>(from trace test) | Prob.  | Fisher Stat.*<br>(from max-eigen test) | Prob.  |
|------------------------------|------------------------------------|--------|--|--------|
| None                         | 141.7                              | 0.0000 | 109.0                                  | 0.0000 |
| At most 1                    | 113.0                              | 0.0000 | 113.0                                  | 0.0000 |

\* Probabilities are computed using asymptotic Chi-square distribution.

ตารางที่ 23 ก ผลการทดสอบความเป็นเหตุเป็นผล กรณี  $\ln(\text{road})_{it}$  เป็นตัวแปรเหตุ

Dependent Variable: D(LNGDP)  
 Method: Panel Least Squares  
 Date: 08/16/12 Time: 02:27  
 Sample (adjusted): 1994 2009  
 Periods included: 16  
 Cross-sections included: 22  
 Total panel (balanced) observations: 352

| Variable      | Coefficient | Std. Error | t-Statistic | Prob.  |
|---------------|-------------|------------|-------------|--------|
| D(LNROAD(-1)) | -0.050573   | 0.036389   | -1.389786   | 0.1656 |
| D(LNROAD(-2)) | -0.030737   | 0.032410   | -0.948367   | 0.3437 |
| D(LNROAD(-3)) | -0.047375   | 0.031668   | -1.496007   | 0.1356 |

|              |           |          |           |        |
|--------------|-----------|----------|-----------|--------|
| D(LNGDP(-1)) | 0.252409  | 0.057033 | 4.425631  | 0.0000 |
| D(LNGDP(-2)) | 0.157959  | 0.045670 | 3.458734  | 0.0006 |
| D(LNGDP(-3)) | -0.081424 | 0.038692 | -2.104395 | 0.0361 |
| ECT1(-1)     | -0.076770 | 0.013867 | -5.536018 | 0.0000 |
| C            | 0.020179  | 0.002183 | 9.241920  | 0.0000 |

## Effects Specification

## Cross-section fixed (dummy variables)

|                    |          |                       |           |
|--------------------|----------|-----------------------|-----------|
| R-squared          | 0.419703 | Mean dependent var    | 0.027841  |
| Adjusted R-squared | 0.369399 | S.D. dependent var    | 0.036668  |
| S.E. of regression | 0.029118 | Akaike info criterion | -4.156105 |
| Sum squared resid  | 0.273864 | Schwarz criterion     | -3.837794 |
| Log likelihood     | 760.4744 | Hannan-Quinn criter.  | -4.029432 |
| F-statistic        | 8.343269 | Durbin-Watson stat    | 1.807270  |
| Prob(F-statistic)  | 0.000000 |                       |           |

Wald Test:

Equation: Untitled

| Test Statistic | Value    | df       | Probability |
|----------------|----------|----------|-------------|
| F-statistic    | 7.351837 | (3, 323) | 0.0001      |
| Chi-square     | 22.05551 | 3        | 0.0001      |

Null Hypothesis: C(1)=0, C(2)=0, C(3)=0

Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value     | Std. Err. |
|------------------------------|-----------|-----------|
| C(1)                         | -0.050573 | 0.036389  |
| C(2)                         | 0.252409  | 0.057033  |
| C(3)                         | -0.030737 | 0.032410  |

Restrictions are linear in coefficients.

ตารางที่ 24 ก ผลการทดสอบความเป็นเหตุเป็นผล กรณี  $\ln(\text{roadper})_{it}$  เป็นตัวแปรเหตุ

Dependent Variable: D(LNGDP)

Method: Panel EGLS (Cross-section random effects)

Date: 09/04/12 Time: 18:02

Sample (adjusted): 1993 2009

Periods included: 17

Cross-sections included: 22

Total panel (balanced) observations: 374

Swamy and Arora estimator of component variances

| Variable         | Coefficient | Std. Error | t-Statistic | Prob.  |
|------------------|-------------|------------|-------------|--------|
| D(LNROADPER(-1)) | 0.033317    | 0.030601   | 1.088750    | 0.2770 |
| D(LNROADPER(-2)) | 0.058474    | 0.030078   | 1.944088    | 0.0526 |
| D(LNGDP(-1))     | 0.504064    | 0.039336   | 12.81424    | 0.0000 |
| D(LNGDP(-2))     | 0.003078    | 0.037117   | 0.082940    | 0.9339 |
| ECT(-1)          | -0.009617   | 0.002235   | -4.302104   | 0.0000 |
| C                | 0.011876    | 0.001801   | 6.593932    | 0.0000 |

| Effects Specification                                       |          |                    |             |
|---|----------|--------------------|-------------|
|   |          | S.D.               | Rho         |
| Cross-section random  |          | 0.000000           | 0.0000      |
| Idiosyncratic random  |          | 0.030973           | 1.0000      |
| Weighted Statistics   |          |                    |             |
| R-squared   | 0.448401 | Mean dependent var | 0.025415    |
| Adjusted R-squared  | 0.440906 | S.D. dependent var | 0.042829    |
| S.E. of regression  | 0.032024 | Sum squared resid  | 0.377405    |
| F-statistic   | 59.83020 | Durbin-Watson stat | 2.066501    |
| Prob(F-statistic)   | 0.000000 |                    |             |
| Unweighted Statistics                                       |          |                    |             |
| R-squared   | 0.448401 | Mean dependent var | 0.025415    |
| Sum squared resid   | 0.377405 | Durbin-Watson stat | 2.066501    |
| Wald Test:<br>Equation: Untitled                            |          |                    |             |
| Test Statistic  | Value    | df                 | Probability |
| F-statistic   | 2.550678 | (2, 368)           | 0.0794      |
| Chi-square  | 5.101355 | 2                  | 0.0780      |
| Null Hypothesis: C(1)=0, C(2)=0<br>Null Hypothesis Summary: |          |                    |             |
| Normalized Restriction (= 0)                                | Value    | Std. Err.          |             |
| C(1)  | 0.033317 | 0.030601           |             |
| C(2)  | 0.058474 | 0.030078           |             |

Restrictions are linear in coefficients.

ตารางที่ 25 ก ผลการทดสอบความเป็นเหตุเป็นผล กรณี  $\ln(railper)_it$  เป็นตัวแปรเหตุ

Dependent Variable: D(LNGDP)

Method: Panel Least Squares

Date: 08/16/12 Time: 03:38

Sample (adjusted): 1994 2009

Periods included: 16

Cross-sections included: 22

Total panel (balanced) observations: 352

| Variable         | Coefficient | Std. Error | t-Statistic | Prob.  |
|------------------|-------------|------------|-------------|--------|
| D(LNRAILPER(-1)) | 0.022033    | 0.036332   | 0.606436    | 0.5447 |
| D(LNRAILPER(-2)) | -0.013685   | 0.037940   | -0.360714   | 0.7185 |
| D(LNRAILPER(-3)) | -0.021889   | 0.037278   | -0.587182   | 0.5575 |
| D(LNGDP(-1))     | 0.250676    | 0.058221   | 4.305630    | 0.0000 |
| D(LNGDP(-2))     | 0.157690    | 0.046424   | 3.396740    | 0.0008 |
| D(LNGDP(-3))     | -0.108071   | 0.038438   | -2.811595   | 0.0052 |
| ECT(-1)          | -0.047178   | 0.011174   | -4.222324   | 0.0000 |

|   |           |                       |             |        |
|---|-----------|-----------------------|-------------|--------|
| C                                       | 0.019174  | 0.002092              | 9.165158    | 0.0000 |
| Effects Specification                   |           |                       |             |        |
| Cross-section fixed (dummy variables)   |           |                       |             |        |
| R-squared                               | 0.403078  | Mean dependent var    | 0.027841    |        |
| Adjusted R-squared                      | 0.351333  | S.D. dependent var    | 0.036668    |        |
| S.E. of regression                      | 0.029532  | Akaike info criterion | -4.127859   |        |
| Sum squared resid                       | 0.281710  | Schwarz criterion     | -3.809549   |        |
| Log likelihood                          | 755.5032  | Hannan-Quinn criter.  | -4.001187   |        |
| F-statistic                             | 7.789631  | Durbin-Watson stat    | 1.781465    |        |
| Prob(F-statistic)                       | 0.000000  |                       |             |        |
| Wald Test:                              |           |                       |             |        |
| Equation: Untitled                      |           |                       |             |        |
| Test Statistic                          | Value     | df                    | Probability |        |
| F-statistic                             | 0.335495  | (3, 323)              | 0.7997      |        |
| Chi-square                              | 1.006484  | 3                     | 0.7997      |        |
| Null Hypothesis: C(1)=0, C(2)=0, C(3)=0 |           |                       |             |        |
| Null Hypothesis Summary:                |           |                       |             |        |
| Normalized Restriction (= 0)            | Value     | Std. Err.             |             |        |
| C(1)                                    | 0.022033  | 0.036332              |             |        |
| C(2)                                    | -0.013685 | 0.037940              |             |        |
| C(3)                                    | -0.021889 | 0.037278              |             |        |

Restrictions are linear in coefficients.

ตารางที่ 26 ก ผลการทดสอบความเป็นเหตุเป็นผล กรณี  $\ln(\text{GDP})_{it}$  เป็นตัวแปรเหตุ

Dependent Variable: D(LNROAD)

Method: Panel Least Squares

Date: 08/16/12 Time: 03:56

Sample (adjusted): 1994 2009

Periods included: 16

Cross-sections included: 22

Total panel (balanced) observations: 352

| Variable      | Coefficient | Std. Error | t-Statistic | Prob.  |
|---------------|-------------|------------|-------------|--------|
| D(LNGDP(-1))  | -0.100265   | 0.085755   | -1.169210   | 0.2432 |
| D(LNROAD(-1)) | -0.088471   | 0.054714   | -1.616959   | 0.1069 |
| D(LNGDP(-2))  | -0.015528   | 0.068668   | -0.226131   | 0.8212 |
| D(LNROAD(-2)) | -0.010029   | 0.048732   | -0.205808   | 0.8371 |
| D(LNGDP(-3))  | 0.014214    | 0.058178   | 0.244316    | 0.8071 |
| D(LNROAD(-3)) | 0.028553    | 0.047615   | 0.599658    | 0.5492 |
| ECT(-1)       | 0.046300    | 0.020851   | 2.220497    | 0.0271 |
| C             | 0.014142    | 0.003283   | 4.307663    | 0.0000 |

Effects Specification



Cross-section fixed (dummy variables)

|                    |          |                       |           |
|--------------------|----------|-----------------------|-----------|
| R-squared          | 0.201320 | Mean dependent var    | 0.010568  |
| Adjusted R-squared | 0.132085 | S.D. dependent var    | 0.046996  |
| S.E. of regression | 0.043782 | Akaike info criterion | -3.340390 |
| Sum squared resid  | 0.619149 | Schwarz criterion     | -3.022080 |
| Log likelihood     | 616.9087 | Hannan-Quinn criter.  | -3.213718 |
| F-statistic        | 2.907768 | Durbin-Watson stat    | 2.061736  |
| Prob(F-statistic)  | 0.000003 |                       |           |

Wald Test:  
Equation: Untitled

| Test Statistic | Value    | df       | Probability |
|----------------|----------|----------|-------------|
| F-statistic    | 1.645284 | (3, 323) | 0.1788      |
| Chi-square     | 4.935851 | 3        | 0.1766      |

Null Hypothesis: C(1)=0, C(2)=0, C(3)=0

Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value     | Std. Err. |
|------------------------------|-----------|-----------|
| C(1)                         | -0.100265 | 0.085755  |
| C(2)                         | -0.088471 | 0.054714  |
| C(3)                         | -0.015528 | 0.068668  |

Restrictions are linear in coefficients.

ตารางที่ 27 ก ผลการทดสอบความเป็นเหตุเป็นผล กรณี  $\ln(\text{GDP})_it$  เป็นตัวแปรเหตุ

Dependent Variable: D(LNROADPER)

Method: Panel EGLS (Cross-section random effects)

Date: 09/04/12 Time: 18:07

Sample (adjusted): 1994 2009

Periods included: 16

Cross-sections included: 22

Total panel (balanced) observations: 352

Swamy and Arora estimator of component variances

| Variable         | Coefficient | Std. Error | t-Statistic | Prob.  |
|------------------|-------------|------------|-------------|--------|
| D(LNGDP(-1))     | 0.031200    | 0.083598   | 0.373218    | 0.7092 |
| D(LNGDP(-2))     | -0.000876   | 0.068446   | -0.012795   | 0.9898 |
| D(LNGDP(-3))     | 0.073536    | 0.054407   | 1.351575    | 0.1774 |
| D(LNROADPER(-1)) | 0.031241    | 0.049634   | 0.629415    | 0.5295 |
| D(LNROADPER(-2)) | 0.107328    | 0.043786   | 2.451211    | 0.0147 |
| D(LNROADPER(-3)) | 0.130281    | 0.043485   | 2.995979    | 0.0029 |
| ECT(-1)          | -0.003564   | 0.003364   | -1.059255   | 0.2902 |

|                       |          |                    |          |          |
|-----------------------|----------|--------------------|----------|----------|
| C                     | 0.000118 | 0.002926           | 0.040317 | 0.9679   |
| Effects Specification |          |                    |          |          |
|                       |          |                    | S.D.     | Rho      |
| Cross-section random  |          |                    | 0.000000 | 0.0000   |
| Idiosyncratic random  |          |                    | 0.044147 | 1.0000   |
| Weighted Statistics   |          |                    |          |          |
| R-squared             | 0.063621 | Mean dependent var |          | 0.004081 |
| Adjusted R-squared    | 0.044566 | S.D. dependent var |          | 0.047282 |
| S.E. of regression    | 0.046217 | Sum squared resid  |          | 0.734783 |
| F-statistic           | 3.338926 | Durbin-Watson stat |          | 2.085187 |
| Prob(F-statistic)     | 0.001865 |                    |          |          |
| Unweighted Statistics |          |                    |          |          |
| R-squared             | 0.063621 | Mean dependent var |          | 0.004081 |
| Sum squared resid     | 0.734783 | Durbin-Watson stat |          | 2.085187 |

Wald Test:  
Equation: Untitled

| Test Statistic | Value    | df       | Probability |
|----------------|----------|----------|-------------|
| F-statistic    | 1.410052 | (3, 344) | 0.2396      |
| Chi-square     | 4.230155 | 3        | 0.2377      |

Null Hypothesis: C(1)=0, C(2)=0, C(3)=0  
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value     | Std. Err. |
|------------------------------|-----------|-----------|
| C(1)                         | 0.031200  | 0.083598  |
| C(2)                         | -0.000876 | 0.068446  |
| C(3)                         | 0.073536  | 0.054407  |

Restrictions are linear in coefficients.

ตารางที่ 28 ก ผลการทดสอบความเป็นเหตุเป็นผล กรณี  $\ln(\text{GDP})_{it}$  เป็นตัวแปรเหตุ

Dependent Variable: D(LNRAILPER)

Method: Panel Least Squares

Date: 08/16/12 Time: 04:32

Sample (adjusted): 1992 2009

Periods included: 18

Cross-sections included: 22

Total panel (balanced) observations: 396

| Variable         | Coefficient | Std. Error | t-Statistic | Prob.  |
|------------------|-------------|------------|-------------|--------|
| D(LNGDP(-1))     | 0.016987    | 0.045754   | 0.371269    | 0.7106 |
| D(LNRAILPER(-1)) | -0.293306   | 0.051889   | -5.652579   | 0.0000 |

|         |           |          |           |        |
|---------|-----------|----------|-----------|--------|
| ECT(-1) | -0.001613 | 0.013547 | -0.119034 | 0.9053 |
| C       | -0.006680 | 0.002597 | -2.571875 | 0.0105 |

---

Effects Specification

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Cross-section fixed (dummy variables)

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|                    |          |                       |           |
|--------------------|----------|-----------------------|-----------|
| R-squared          | 0.106937 | Mean dependent var    | -0.004451 |
| Adjusted R-squared | 0.049165 | S.D. dependent var    | 0.047586  |
| S.E. of regression | 0.046402 | Akaike info criterion | -3.241908 |
| Sum squared resid  | 0.798809 | Schwarz criterion     | -2.990556 |
| Log likelihood     | 666.8978 | Hannan-Quinn criter.  | -3.142330 |
| F-statistic        | 1.851007 | Durbin-Watson stat    | 2.107171  |
| Prob(F-statistic)  | 0.009475 |                       |           |

---

Wald Test:  
Equation: Untitled

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| Test Statistic | Value    | df       | Probability |
|----------------|----------|----------|-------------|
| t-statistic    | 0.371269 | 371      | 0.7106      |
| F-statistic    | 0.137840 | (1, 371) | 0.7106      |
| Chi-square     | 0.137840 | 1        | 0.7104      |

---

Null Hypothesis: C(1)=0  
Null Hypothesis Summary:

---

| Normalized Restriction (= 0) | Value    | Std. Err. |
|------------------------------|----------|-----------|
| C(1)                         | 0.016987 | 0.045754  |

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Restrictions are linear in coefficients.

### ตารางที่ 29 ก ผลการประมาณค่าความถัมพันธ์ ด้วยวิธี OLS

Dependent Variable: LNGDP  
Method: Panel Least Squares  
Date: 08/16/12 Time: 05:38  
Sample: 1990 2009  
Periods included: 20  
Cross-sections included: 22  
Total panel (balanced) observations: 440

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| LNROAD   | 0.961021    | 0.053304   | 18.02890    | 0.0000 |
| C        | -2.068018   | 0.643754   | -3.212436   | 0.0014 |

---

Effects Specification

---

Cross-section fixed (dummy variables)

---

|                    |          |                    |          |
|--------------------|----------|--------------------|----------|
| R-squared          | 0.975772 | Mean dependent var | 9.537375 |
| Adjusted R-squared | 0.974493 | S.D. dependent var | 0.978969 |

|                    |          |                       |           |
|--------------------|----------|-----------------------|-----------|
| S.E. of regression | 0.156349 | Akaike info criterion | -0.822591 |
| Sum squared resid  | 10.19361 | Schwarz criterion     | -0.608964 |
| Log likelihood     | 203.9700 | Hannan-Quinn criter.  | -0.738315 |
| F-statistic        | 763.3716 | Durbin-Watson stat    | 0.225068  |
| Prob(F-statistic)  | 0.000000 |                       |           |

### ตารางที่ 30 ก ผลการประมาณค่าความสัมพันธ์ ด้วยวิธี OLS

Dependent Variable: LNGDP  
Method: Panel EGLS (Cross-section random effects)  
Date: 09/04/12 Time: 18:12  
Sample: 1990 2009  
Periods included: 20  
Cross-sections included: 22  
Total panel (balanced) observations: 440  
Swamy and Arora estimator of component variances

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| LNRAIL   | 0.136936    | 0.101023   | 1.355496    | 0.1760 |
| C        | 8.343410    | 0.906396   | 9.205039    | 0.0000 |

#### Effects Specification

|                      | S.D.     | Rho    |
|----------------------|----------|--------|
| Cross-section random | 1.001493 | 0.9587 |
| Idiosyncratic random | 0.207772 | 0.0413 |

#### Weighted Statistics

|                    |          |                    |          |
|--------------------|----------|--------------------|----------|
| R-squared          | 0.004174 | Mean dependent var | 0.441963 |
| Adjusted R-squared | 0.001900 | S.D. dependent var | 0.208060 |
| S.E. of regression | 0.207862 | Sum squared resid  | 18.92449 |
| F-statistic        | 1.835782 | Durbin-Watson stat | 0.083689 |
| Prob(F-statistic)  | 0.176145 |                    |          |

#### Unweighted Statistics

|                   |           |                    |          |
|-------------------|-----------|--------------------|----------|
| R-squared         | -0.030161 | Mean dependent var | 9.537375 |
| Sum squared resid | 433.4187  | Durbin-Watson stat | 0.003654 |

### ตารางที่ 31 ก ผลการประมาณค่าความสัมพันธ์ ด้วยวิธี OLS

Dependent Variable: LNGDP  
Method: Panel EGLS (Cross-section random effects)  
Date: 09/04/12 Time: 18:13  
Sample: 1990 2009  
Periods included: 20  
Cross-sections included: 22  
Total panel (balanced) observations: 440  
Swamy and Arora estimator of component variances

| Variable  | Coefficient | Std. Error | t-Statistic | Prob.  |
|-----------|-------------|------------|-------------|--------|
| LNROADPER | 0.740140    | 0.062513   | 11.83969    | 0.0000 |

|                       |          |                    |          |        |
|-----------------------|----------|--------------------|----------|--------|
| C                     | 8.100396 | 0.197727           | 40.96749 | 0.0000 |
| Effects Specification |          |                    |          |        |
|                       |          |                    | S.D.     | Rho    |
| Cross-section random  |          |                    | 0.731000 | 0.9408 |
| Idiosyncratic random  |          |                    | 0.183342 | 0.0592 |
| Weighted Statistics   |          |                    |          |        |
| R-squared             | 0.242866 | Mean dependent var | 0.534042 |        |
| Adjusted R-squared    | 0.241137 | S.D. dependent var | 0.210226 |        |
| S.E. of regression    | 0.183133 | Sum squared resid  | 14.68959 |        |
| F-statistic           | 140.4970 | Durbin-Watson stat | 0.137394 |        |
| Prob(F-statistic)     | 0.000000 |                    |          |        |
| Unweighted Statistics |          |                    |          |        |
| R-squared             | 0.456915 | Mean dependent var | 9.537375 |        |
| Sum squared resid     | 228.4917 | Durbin-Watson stat | 0.008833 |        |

### ตารางที่ 32 ก ผลการประมาณค่าความสัมพันธ์ ด้วยวิธี OLS

Dependent Variable: LNGDP  
 Method: Panel Least Squares  
 Date: 10/01/12 Time: 20:49  
 Sample: 1990 2009  
 Periods included: 20  
 Cross-sections included: 22  
 Total panel (balanced) observations: 440

| Variable  | Coefficient | Std. Error | t-Statistic | Prob.  |
|-----------|-------------|------------|-------------|--------|
| LNRAILPER | -0.916750   | 0.128391   | -7.140300   | 0.0000 |
| C         | 8.239731    | 0.181977   | 45.27888    | 0.0000 |

| Effects Specification                 |          |                       |           |  |
|---------------------------------------|----------|-----------------------|-----------|--|
| Cross-section fixed (dummy variables) |          |                       |           |  |
| R-squared                             | 0.961583 | Mean dependent var    | 9.537375  |  |
| Adjusted R-squared                    | 0.959556 | S.D. dependent var    | 0.978969  |  |
| S.E. of regression                    | 0.196877 | Akaike info criterion | -0.361620 |  |
| Sum squared resid                     | 16.16312 | Schwarz criterion     | -0.147993 |  |
| Log likelihood                        | 102.5564 | Hannan-Quinn criter.  | -0.277344 |  |
| F-statistic                           | 474.4359 | Durbin-Watson stat    | 0.148162  |  |
| Prob(F-statistic)                     | 0.000000 |                       |           |  |

## ประวัติผู้เขียน

ชื่อ-สกุล

นายปราชญา รัตตมงคล

วัน เดือน ปี เกิด

1 มิถุนายน 2528

ประวัติการศึกษา

สำเร็จการศึกษามัธยมศึกษาตอนปลาย โรงเรียนยุพราชวิทยาลัย  
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