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(ARDL)

(ECM)

.L13 ,L1 ,C22 ,C2 :JEL

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(Q)

(C)

F.O.C

:( r x )

$$\text{Min } C = \sum_{i=1}^n r_i x_i$$

$$\text{s.t } Q = f(x_1, x_2, \dots, x_n) \text{ s.t } Q = f(x_1, x_2, \dots, x_n) \quad ( )$$

$$L = \sum_{i=1}^n r_i x_i - \lambda [f(x_1, x_2, \dots, x_n) - Q]$$

$$\begin{cases} \frac{\partial L}{\partial x_1} = r - \lambda f_1 = 0 \\ \frac{\partial L}{\partial x_n} = r_n - \lambda f_n = 0 \\ \frac{\partial L}{\partial \lambda} = f(x_1, x_2, \dots, x_n) - Q = 0 \end{cases}$$

$$x_1^* = x_1^*(r_1, \dots, r_n, Q)$$

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$$x_n^* = x_n^*(r_1, \dots, r_n, Q)$$

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$x_i^*$

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$$C = C(r_1, \dots, r_n, Q) = \sum_{i=1}^n r_i x_i(r_1, \dots, r_n, Q) \quad ( )$$

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$$\frac{\partial C}{\partial r_i} = x_i(r_1, \dots, r_n, Q) + \sum r_i \frac{\partial x_i(r_1, \dots, r_n, Q)}{\partial r_i} \quad (1)$$

$$x_i^d = x_i(r_1, \dots, r_n, Q) \quad (2)$$

$$C = C(w, Kp, Pco, Q) \quad (3)$$

Kp ( ) w Pco

$$L^d = L(w, Kp, Pco, Q) \quad (4)$$

$$X_1 = X_1(r_1, \dots, r_n, Q)$$

$$\frac{\partial X_1}{\partial r_i} \cdot r_i + \dots + \frac{\partial X_n}{\partial r_n} = n X_1(r_1, \dots, r_n, Q)$$

(ARDL)

VAR

VAR

( ) (ARDL)

VAR

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- 1- Auto-Regressive Distributed lag (ARDL).
  - 2- Co-integration.
  - 3- Pesaran & shin (1999).



ARDL ( )

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$$\log L^d = \alpha_0 + \sum_{j=1}^p \alpha_j \log L_{t-j}^d + \sum_{j=0}^{q_1} \beta_{1j} \log Q_{t-j} + \sum_{j=0}^{q_2} \beta_{2j} \log w_{t-j} + \sum_{j=0}^{q_3} \beta_{3j} \log Kp_{t-j} + \sum_{j=0}^{q_4} \beta_{4j} \log Pco_{t-j} + \delta Dum + \delta' t + u_t \quad u_t \sim iid(0, \sigma^2) \quad ( )$$

(w)

(Kp)

(Pco)

Microfit

$$\log L^d = 7.17 + 0.51 \log L^d (-1) + 0.16 \log Q - 0.32 \log W \quad ( )$$

(t): (8) (6.7) (3.4) (-3.4)

$$-0.32 \log Pco - 0.03 \log Kp (-1) + 0.06t + 0.02 Dum( )$$

(-6.8) (-2.7) (7.6) (1.23)

$$R^2 = 0.99 \quad F(6,20) = 207.55$$

$$\bar{R}^2 = 0.98 \quad D.W = 1.95$$

(Kp)



$R^2$  .

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ARDL

(SBC)

$$\begin{aligned}
 & : \\
 & \left\{ \begin{array}{l} H_0 : \alpha_1 - 1 \geq 0 \\ H_1 : \alpha_1 - 1 < 0 \end{array} \right. \\
 & : \\
 & t = \frac{\hat{\alpha}_1 - 1}{S_{\hat{\alpha}_1}} = \frac{0.51 - 1}{0.077} = -6.36
 \end{aligned}$$

$$\begin{aligned}
 & : \\
 & \log L^d = 1.48 + 0.34 \log Q - 0.66 \log w - 0.05 \log Kp - 0.66 Pco \\
 & (t) : (2.6) \quad (-2.67) \quad (-1.79) \quad (-4.07) \quad (1.24) \\
 & \quad + 0.04 Dum + 0.12 t \\
 & \quad (4.83) \quad (9.5)
 \end{aligned}$$

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[Redacted]

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(W)

(ECM)

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ARDL  
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(ECM)

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