

A Technical note about the Industrial security

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Let,

Foreign unknown source = F

Political influences = P

Industrial officers and workers = IOW

Local business cartels = LBC

Influences from the Government officials = IGO

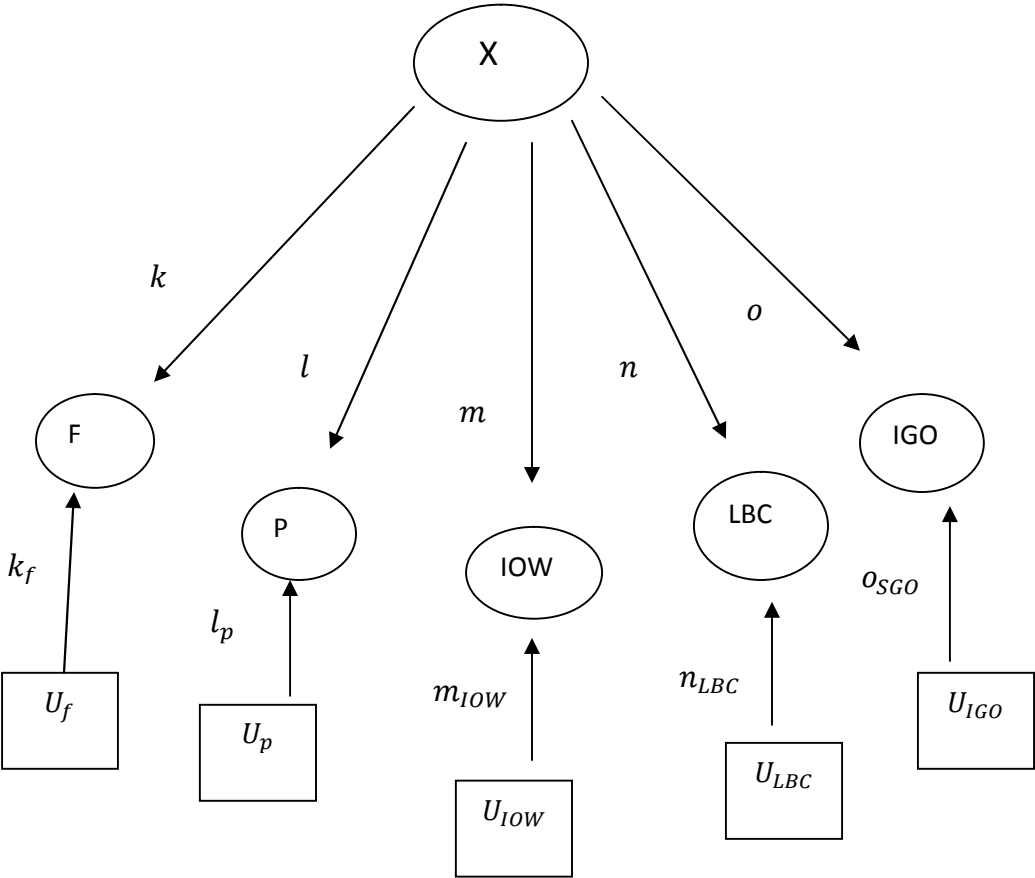
An unknown common latent factor = X

$$\begin{aligned}F &= k X + k_f u_f \\P &= l X + k_f u_p \\IOW &= m X + m_f u_{IOW} \\LBC &= n X + n_f u_{LBC} \\IGO &= o X + o_f u_{SGO}\end{aligned}$$

One Factor
and Five
Indicators

	F	P	IOW	LBC	IGO
F	a_{11}	a_{12}	a_{13}	a_{14}	a_{15}
P	a_{21}	a_{22}	a_{23}	a_{24}	a_{25}
IOW	a_{31}	a_{32}	a_{33}	a_{34}	a_{35}
LBC	a_{41}	a_{42}	a_{43}	a_{44}	a_{45}
IGO	a_{51}	a_{52}	a_{53}	a_{54}	a_{55}

Cross
Correlati
on Matrix



Different framework is possible

$$\begin{aligned}
 F &= k.X + a.P + b.LBC + c.IOW + d.IGO + \gamma_f U'_f \\
 LBC &= k_{LBC}.X + a_{LBC}.P + b_{LBC}.LBC + c_{LBC}.IOW + d_{LBC}.IGO + \gamma_f U'_f \\
 IOW &= c_{IOW}.LBC
 \end{aligned}$$

The whole framework will have an impact on the industrial production

Let,

Industrial production = Y

Political dummy = D_{pt}

Activity Level = $a_1 \rightarrow D_p = 0$

Activity Level = $a_2 \rightarrow D_p \neq 0$

Working hour of the group of worker and officer = $WH_k, k = 1 \dots n$

$$Y = \beta_1 D_{pt} + \beta_2 \left(\frac{NO_2}{CO_2} \right) + \beta_3 \left(\frac{CaCl_2}{O_2H} \right) + \beta_{41}(WH_1) + \dots + \beta_{4k}(WH_k) + U_Y$$

A possible linear regression model

$\frac{NO_2}{CO_2} \rightarrow NO_2, CO_2 \text{ ratio in Air}$

$\frac{CaCl_2}{H_2O} \rightarrow CaCl_2, H_2O \text{ ratio in Water}$

For the classification of the worker and officer it is possible to use for example:

1. Region
2. Education
3. Expertise (need to define)
4. Their religious activities (need to define the activity level)
5. Number of conflict (fighting attitude)
Category of the conflict ->
 1. Protest
 2. Crime
6. Married /Unmarried
7. Number of Children
8. Extra Curriculum
9. Hobby
- etc.

We can also analysis the framework by using the constant-elasticity -of-substitution model of the production.

Group Classification : Group-1Group-k

Production function of the two factor case:

Two Factor CES Production Function

$$Y' = \gamma' [k' X_1'^{-\alpha} + (1 - k') X_2'^{-\alpha}]^{-\frac{r}{\alpha}}$$

$Y' \rightarrow$ Output

$X_1' \rightarrow$ Factor 1

$X_2' \rightarrow$ Factor 2

$\gamma' \rightarrow$ Denotes the efficiency of a Production function

$r \rightarrow$ Homogeneity parameter ; Representing the Degree of returns to scale

$r > 1 \rightarrow$ Economics of scale

$r = 1 \rightarrow$ Constant returns

$r < 1 \rightarrow$ Diseconomies of scale

$k' \rightarrow$ Intensity Parameter

$$\alpha = \frac{1}{\sigma} - 1$$

We can include more factors:

Generalized CES Production Function

$$Y' = \gamma' [k_1' X_1'^{-\alpha} + k_2' X_2'^{-\alpha} + k_3' X_3'^{-\alpha} + k_4' X_4'^{-\alpha}]^{-\frac{r}{\alpha}}$$

Another Generalized CES Production Function

$$Y' = \gamma' [k'_1 X'^{-\alpha_1}_1 + k'_2 X'^{-\alpha_1}_2]^{\frac{r_1}{\alpha_1}} \cdot [k'_3 X'^{-\alpha_2}_3 + k'_4 X'^{-\alpha_2}_4]^{\frac{r_2}{\alpha_2}}$$

$\alpha_1, \alpha_2 \rightarrow$ Partial elasticity of substitution

Let,

$$Y' = \gamma' \cdot e^{\lambda \cdot t} \cdot [k' X'^{-\alpha}_1 + (1 - k') X'^{-\alpha}_2]^{-\frac{r}{\alpha}}$$

$$r = 1$$

$$Y' = \gamma' \cdot e^{\lambda \cdot t} \cdot [k' X'^{-\alpha}_1 + (1 - k') X'^{-\alpha}_2]^{-\frac{1}{\alpha}}$$

$\lambda \rightarrow$ rate of technical change

By taking log on the both side,

$$\ln(Y') = \ln(\gamma') + \lambda \cdot t + b'_2 \ln(X'_1) + b'_3 \ln(X'_2) + b'_4 \ln\left(\frac{X'_1}{X'_2}\right)^2$$

$$b'_2 = k'$$

$$b'_3 = 1 - k'$$

$$b'_4 = -\left(\frac{1}{2}\right) k' \cdot (1 - k') \cdot \alpha$$

We can estimate the co-efficient

$$\text{Elasticity of substitution } \sigma = \frac{1}{1 + \alpha}$$

Ref: Book and Research Papers (Own Collection)

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Let ,

LGP = Liquid – Chemical – Gas-Pressure

FGS = Frequency of the ground shake

TI = Time Interval

ED = Error of the Design

C = Maximum Capacity of the Chemical Plant

WA = Warning before the destruction of the plant (number for example)

t = Flow of the Time

where, t = 1T

$$C_t = \beta_{10} + \beta_{11}C_{t-1} + \beta_{12}FGS_t + \beta_{13}LSP_{t-1} + \beta_{16}ED_t + \beta_{14}TI + \beta_{15}WA_t + v_t^c$$

$$LGP_t = \beta_{20} + \beta_{21}LGP_{t-1} + \beta_{22}FGS_t + \beta_{23}C_{t-1} + \beta_{24}TI + \beta_{25}WA_t + \beta_{26}ED_t + v_t^{LGP}$$

.....
..... Need at least 6 equations to solve the system
mathematically, or we can use OLS separately , otherwise

We can use OLS

$$C_t \sim I(0)$$

$$LGP_t \sim I(0)$$

.....

$$\Delta C_t = \beta_{10} + \beta_{11} \Delta C_{t-1} + \beta_{12} \Delta FGS_t + \beta_{13} \Delta LSP_{t-1} + \beta_{16} \Delta ED_t + \beta_{14} \Delta TI + \beta_{15} \Delta WA_t + v_t^{\Delta C}$$

$$\Delta LGP_t = \beta_{20} + \beta_{21} \Delta LGP_{t-1} + \beta_{22} \Delta FGS_t + \beta_{23} \Delta C_{t-1} + \beta_{24} \Delta TI + \beta_{25} \Delta WA_t + \beta_{26} \Delta ED_t + v_t^{\Delta LGP}$$

$$C_t \sim I(1)$$

$$LGP_t \sim I(1)$$

.....

C_t and LGP_t are not co-integrated and so on

VAR

$$C_t \sim I(1)$$

$$LGP_t \sim I(1)$$

.....

C_t and LGP_t are not co-integrated and so on

Check the impulse response

VECM

You can also check the stability of the system(Please check the standard text book)

$$\begin{bmatrix} \dot{y}_1 \\ \dot{y}_2 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} + \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$$

$$\dot{Y} = A \cdot Y + B$$

Complementary solution

$$y_c = \sum_{i=1}^n k_i C_i e^{r_i t} = k_1 C_1 e^{r_1 t} + k_2 C_2 e^{r_2 t}$$

k_i = a scalar or constant

$C_i = (2 \times 1)$ column vector of constants called an eigenvector

r_i = a scalar called the characteristic root

$$r_i = \frac{\text{tr}(A) \pm \sqrt{|\text{tr}(A)|^2 - 4|A|}}{2}$$

$$(A - r_i \cdot I)C_i = 0$$

$$(A - r_i \cdot I) = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} - r_i \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} a_{11} - r_i & a_{12} \\ a_{21} & a_{22} - r_i \end{bmatrix}$$

k_i is a scalar

$(A - r_i \cdot I)C_i = 0$ is a Eigen value problem

If we solve this Eigen value problem we will find the Eigen vector.

Intertemporal and the steady-state solution is,

$$y_p = \bar{Y} = -A^{-1} B$$

The complete general solution,

$$y(t) = y_c + y_p$$

If all $r_i < 0 \rightarrow$ The model is dynamically stable

If all $r_i > 0 \rightarrow$ The model is dynamically unstable

If r_i have different signs

\rightarrow The solution is at a saddle – point equilibrium and the model is unstable

Ref: Books, Research Papers (My own collection)

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