Chapter A

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

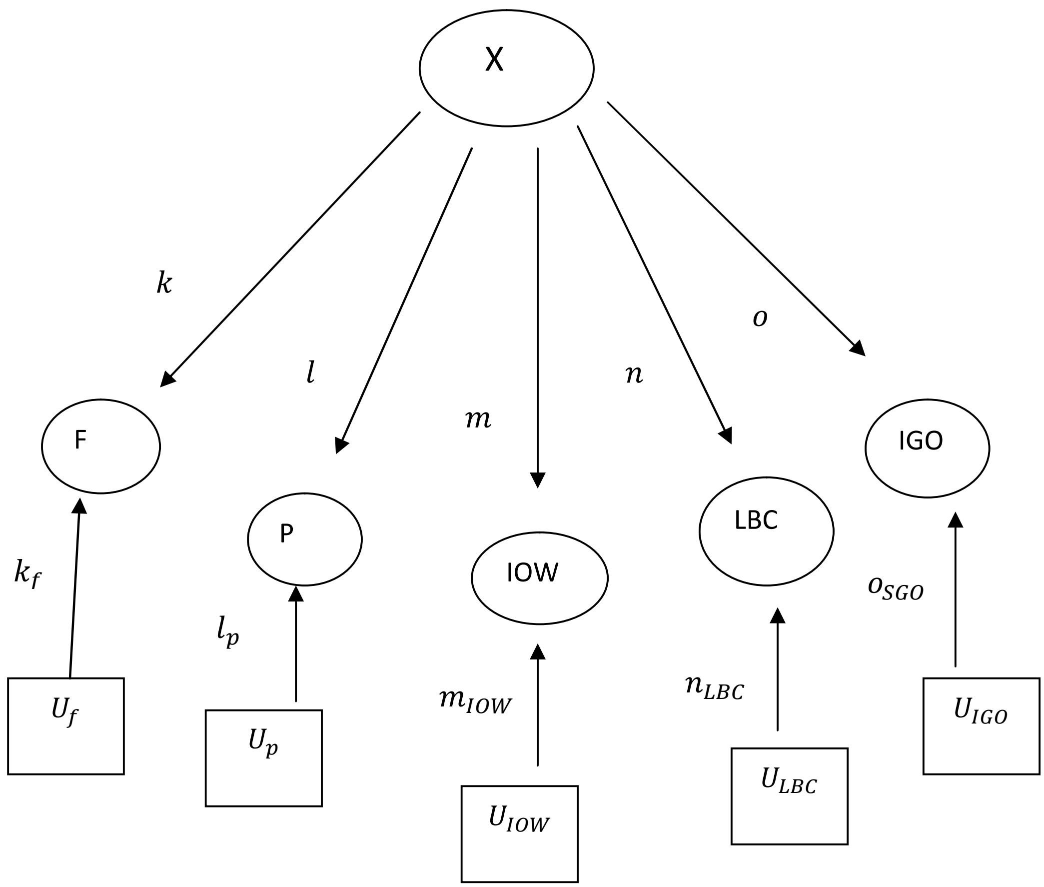
Influences from the Government officials = IGO

An unknown common latent factor = X

$$\left.\begin{aligned} F &= k\,X \;+ k_f\,u_f \\ P &= l\,X \;+ k_f\,u_p \\ IOW &= m\,X \;+ m_f\,u_{IOW} \\ LBC &= n\,X \;+ n_f\,u_{LBC} \\ IGO &= o\,X \;+ o_f\,u_{SGO} \end{aligned}\right\} \text{One Factor and Five Indicators}$$

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

Cross
Correlati
on Matrix



Different framework is possible

$$F = k.X + \boldsymbol{a}.\boldsymbol{P} + \boldsymbol{b}.\boldsymbol{LBC} + \boldsymbol{c}.\boldsymbol{IOW} + \boldsymbol{d}.\boldsymbol{IGO} + \boldsymbol{\gamma_f U'_f}$$

$$\boldsymbol{LBC} = \boldsymbol{k_{LBC}}.X + \boldsymbol{a_{LBC}}.\boldsymbol{P} + \boldsymbol{b_{LBC}}.\boldsymbol{LBC} + \boldsymbol{c_{LBC}}.\boldsymbol{IOW} + \boldsymbol{d_{LBC}}.\boldsymbol{IGO} + \boldsymbol{\gamma_f U'_f}$$

$$\boldsymbol{IOW} = \boldsymbol{c_{IOW}}.\boldsymbol{LBC}$$

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 = $WH_k, k = 1 \ldots n$

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

A possible linear regression model

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

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

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.

Group Classification : Group-1 ....Group-k

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

Production function of the two factor case:

Two Factor CES Production Function

$$Y' = \gamma'[k'X'^{-\alpha}_1 + (1 - k')X'^{-\alpha}_1]^{-\frac{r}{\alpha}}$$

$Y' \rightarrow Output$

$X'_1 \rightarrow Factor\ 1$

$X'_2 \rightarrow Factor\ 2$

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

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

$r > 1 \rightarrow Economics\ of\ scale$

$r = 1 \rightarrow Constant\ returns$

$r < 1 \rightarrow Diseconomics\ of\ scale$

$k' \rightarrow Intensity\ Parameter$

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

We can include more factors:

Generalized CES Production Function

$Y' = \gamma'[k'_1X'^{-\alpha}_1 + k'_2X'^{-\alpha}_2 + k'_3X'^{-\alpha}_3 + k'_4X'^{-\alpha}_4]^{-\frac{r}{\alpha}}$

$Another\ Generalized\ CES\ Production\ Function$

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

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

Let,

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

$r\ =\ 1$

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

$\lambda\ \rightarrow\ rate\ of\ technical\ change$

By taking log on the both side,

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

$$\underbrace{\left.\begin{aligned} b'_2 &= k' \\ b'_3 &= 1-k' \\ b'_4 &= -\left(\frac{1}{2}\right)k'.(1-k').\alpha \end{aligned}\right\}}$$

We can estimate the co-efficient

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

Ref: Book and Research Papers (Own Collection)

Chapter B

A Technical note about the Industrial security

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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 = 1 ....T

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

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

....

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

We can use OLS

$C_t \sim I(0)$

$LGP_t \sim I(0)$

....

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

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

$C_t \sim I(1)$

$LGP_t \sim I(1)$

....

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)

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

$$\dot{Y} = A\,.Y + B$$

Complementary solution

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

$k_i = a\ scalar\ or\ constant$

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

$r_i = a\ scalar\ called\ the\ characteristic\ root$

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

$$(A - r_i.I)C_i = 0$$

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

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

$k_i is\ a\ scalar$

$(A - r_i.I)C_i = 0$ 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,

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

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

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

$If\ \ r_i\ have\ different\ sings$

$-> \ The\ solution\ is\ at\ a\ saddle - point\ equilibrium\ and\ the\ model\ is\ unstable$

Ref: Books, Research Papers (My own collection)

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