Convergence

Real convergence: economic convergence and social performance in terms of real variables, e.g. convergence of GDP per capita, productivity, competitiveness.

Upward convergence: convergence of Member States towards better working and living conditions.

Beta convergence

$$ln(\Delta y_{i,t}) = \alpha_0 + \beta ln(y_{i,0}) + \varepsilon_t$$

H0: $\beta = 0$ lack of beta convergence (divergence).,
H1: $\beta \neq 0$ there is beta convergence (if β is negative) or divergence (if β is positive).

Sigma convergence

Analysis of the development of any measure of variability.

H0: $V_{t1} = V_{t2} = V_{tk}$ there is no sigma convergence (divergence)

H1: $V_{t1} > V_{t2}$ there is a sigma convergence

H1a: $V_{t1} < V_{t2}$ there is a sigma divergence

Gamma convergence

In a situation where beta convergence occurs, and sigma convergence does not occur, a gamma convergence process may have been observed.

Tau-Kendall correlation coefficient analysis

H0: $\tau = 0$ gamma convergence occurs

H1: $\tau \neq 0$ there is no gamma convergence

Delta convergence

$$\delta_t = \sum_{i=1}^{N} \left(MAX\left(x_{i,t}\right) - x_{i,t} \right)$$

Upward convergence

Weak sense

$$\begin{cases} g(X_t) < g(X_{t-i}) \\ \mu\big(X(t)\big) \geq \mu\big(X(t-i)\big) \end{cases}$$

Strict sense

$$\begin{cases} g(X_t) < g(X_{t-i}) \\ X(t,j) \geq X(t-i,j)\ \forall\, j = 1, \dots, n \end{cases}$$

Downward convergence

Weak sense

$$\begin{cases} g(X_t) < g(X_{t-i}) \\ \mu\big(X(t)\big) < \mu\big(X(t-i)\big) \end{cases}$$

Strict sense

$$\begin{cases} g(X_t) < g(X_{t-i}) \\ X(t,j) < X(t-i,j)\ \forall\, j = 1, \dots, n \end{cases}$$

Upward dovergence

Weak sense

$$\begin{cases} g(X_t) \geq g(X_{t-i}) \\ \mu\big(X(t)\big) \geq \mu\big(X(t-i)\big) \end{cases}$$

Strict sense

$$\begin{cases} g(X_t) \geq g(X_{t-i}) \\ X(t,j) \geq X(t-i,j) \; \forall \, j = 1, \dots, n \end{cases}$$

Downward divergence

Weak sense

$$\begin{cases} g(X_t) \geq g(X_{t-i}) \\ \mu\big(X(t)\big) < \mu\big(X(t-i)\big) \end{cases}$$

Strict sense

$$\begin{cases} g(X_t) \geq g(X_{t-i}) \\ X(t,j) < X(t-i,j)\ \forall\, j = 1, \dots, n \end{cases}$$

Scenarios

Catching up

$$\nabla\mu_{EU} > 0; \nabla\mu_{EU} < \nabla f_{MS}; \nabla f_{MS} > 0;\ \Delta_{t,t-1}\sigma^2 < 0$$

Flattening

$$\nabla\mu_{EU} > 0; \nabla\mu_{EU} > \nabla f_{MS}; \nabla f_{MS} > 0;\ \Delta_{t,t-1}\sigma^2 < 0$$

Inversion

$$\nabla\mu_{EU} > 0; \nabla\mu_{EU} > \nabla f_{MS}; \nabla f_{MS} < 0;\ \Delta_{t,t-1}\sigma^2 < 0$$

Underperforming

$$\nabla\mu_{EU} < 0; \nabla\mu_{EU} > \nabla f_{MS}; \nabla f_{MS} < 0;\ \Delta_{t,t-1}\sigma^2 < 0$$

Recovering

$$\nabla\mu_{EU} < 0; \nabla\mu_{EU} < \nabla f_{MS}; \nabla f_{MS} > 0;\ \Delta_{t,t-1}\sigma^2 < 0$$

Reacting better

$$\nabla\mu_{EU} < 0; \nabla\mu_{EU} < \nabla f_{MS}; \nabla f_{MS} < 0;\ \Delta_{t,t-1}\sigma^2 < 0$$

Scenarios

Outperforming

$$\nabla\mu_{EU} > 0; \nabla\mu_{EU} < \nabla f_{MS}; \nabla f_{MS} > 0;\ \Delta_{t,t-1}\sigma^2 > 0$$

Slower pace

$$\nabla\mu_{EU} > 0; \nabla\mu_{EU} > \nabla f_{MS}; \nabla f_{MS} > 0;\ \Delta_{t,t-1}\sigma^2 > 0$$

Diving

$$\nabla\mu_{EU} > 0; \nabla\mu_{EU} > \nabla f_{MS}; \nabla f_{MS} < 0;\ \Delta_{t,t-1}\sigma^2 > 0$$

Defending better

$$\nabla\mu_{EU} < 0; \nabla\mu_{EU} < \nabla f_{MS}; \nabla f_{MS} < 0;\ \Delta_{t,t-1}\sigma^2 > 0$$

Escaping

$$\nabla\mu_{EU} < 0; \nabla\mu_{EU} < \nabla f_{MS}; \nabla f_{MS} > 0;\ \Delta_{t,t-1}\sigma^2 > 0$$

Falling away

$$\nabla\mu_{EU} < 0; \nabla\mu_{EU} > \nabla f_{MS}; \nabla f_{MS} < 0;\ \Delta_{t,t-1}\sigma^2 > 0$$