

A Dynamic Assessment of Knowledge Based Economy Indices

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Overview

1. Methodology
2. Application
3. Conclusions

Overview

1. Methodology

- Measuring performance change
- Decomposing performance change
- Endogenously defined weights

Based on:

- Färe, Grosskopf, Norris, Zhang (1994, American Economic Review)
- Cherchye, Lovell, Moesen, Van Puyenbroeck (2005, to appear in European Economic Review)

Overview

1. Methodology
 - Measuring performance change

1. Methodology: measuring performance change

- Performance change between periods 0 and 1:

$$PC = \text{Performance}^1 / \text{Performance}^0$$

$PC > 1 \rightarrow$ performance progress

$PC < 1 \rightarrow$ performance regress

- Multidimensional outcome vectors \mathbf{y}^0 and \mathbf{y}^1
 \rightarrow “composite” performance change

$$PC = (\mathbf{w} \cdot \mathbf{y}^1) / (\mathbf{w} \cdot \mathbf{y}^0)$$

for “policy” weighting vector \mathbf{w}

1. Methodology: measuring performance change

Choice of the weighting vector \mathbf{w} ?

- Natural candidates:

- Policy weights in period 0: \mathbf{w}^0

- $PC^0 = (\mathbf{w}^0 \cdot \mathbf{y}^1) / (\mathbf{w}^0 \cdot \mathbf{y}^0)$

- Policy weights in period 1: \mathbf{w}^1

- $PC^1 = (\mathbf{w}^1 \cdot \mathbf{y}^1) / (\mathbf{w}^1 \cdot \mathbf{y}^0)$

- Fischer-type index avoids ‘arbitrary’ base of comparison:

$$PC = (PC^0)^{1/2} \times (PC^1)^{1/2}$$

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1. Methodology: decomposing performance change

- Idea: distinguish between two sources of performance change, namely...
 - **Catching up (CU)**: country performance gets closer to best possible performance
 - “the country is doing better as compared to the world’s best practice benchmark”
 - **Environmental change (EC)**: performance change due to a ‘more favorable’ policy environment
 - “the world gets better”

1. Methodology: decomposing performance change

Decomposition:

$$PC = CU \times EC$$

for

PC = performance change

CU = catching up

EC = environmental change

1. Methodology: decomposing performance change

$$PC = \mathbf{CU} \times EC \quad \rightarrow \quad \mathbf{CU} = \text{catching up}$$

- Definition: $CU = RP^1 / RP^0$

with RP^t ($t=0,1$) = ‘relative performance in period t vis-à-vis best practice in period t ’

Formally (for $t = 0,1$): $RP^t = (\mathbf{w}^t \cdot \mathbf{y}^t) / \max_{\mathbf{y}^t_B} (\mathbf{w}^t \cdot \mathbf{y}^t_B)$
(\mathbf{y}^t_B : benchmark performance, in country sample for period t)

→ $RP^t \leq 100\%$ and $RP^t = 100\%$ means “best practice in t ”

- Interpretation: $CU > 1$

→ $RP^1 > RP^0$

→ “performance progress due to catching up with the best possible practice”

1. Methodology: decomposing performance change

$$PC = CU \times EC \quad \rightarrow \quad EC = \text{environmental change}$$

Idea :

- For the given policy mix (of the evaluated country) it compares the best practice in period 0 and best practice in period 1
- Interpretation (of $EC > 1$):
 - For the given policy mix, the best practice in period 1 dominates the best practice in period 0
 - Thus: better ‘best practice’ in period 1 than in period 0
 - ... which suggest a favorable environmental change, resulting in performance progress

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1. Methodology: endogenously defined weights

- Problem: what if the policy weights \mathbf{w}^0 and \mathbf{w}^1 are not known ?
- Solution: apply endogenous 'benefit of the doubt' weighting (see before), possibly complemented with weight restrictions
- (Practically, this boils down to solving 4 LP problems for each evaluated country)

Overview

1. Methodology
2. Application: performance changes in terms of KBE policy
 - Data and model specification
 - Results

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1. Methodology
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2. Application: data and model specification

- 15 EU countries + 9 other OECD countries
(Australia, Canada, Iceland, Japan, Korea, New Zealand, Norway, Switzerland, United States)
- Three dimensions of KBE performance (sensu lato):
 - Dimension A: “KBE performance sensu strictu”
(including patents, researchers, ...)
 - Dimension B: “overall economic performance”
(including GDP per capita (PPP), labor productivity, ...)
 - Dimension C: “openness of the economy”
(including expenditures on R&D abroad, ...)

2. Application: data and model specification

- Three periods:
 - 81-91 (before Maastricht)
 - 92-99 (Maastricht – Lisbon)
 - 00-04 (after Lisbon)
- Model:
 - Endogenous (benefit-of-the-doubt) weights for aggregating A, B and C dimensions
 - No weight restrictions
 - Levels and changes (including CU and EC)

Overview

1. Methodology
2. Application: performance changes in terms of KBE policy
 - Data and model specification
 - Results
 - “best practice” countries in 3 periods
 - Overall performance changes
 - Catching up
 - Environmental change

2. Application: results

Best practice countries:

- 81-91: Japan, Switzerland, United States
- 92-00: Germany, Japan, United States
- 00-04: Finland, Japan, United States

Median relative performance, EU countries:

- 81-91: 61.95%
→ min: 37.22% (Austria); max: 91.15% (Belgium)
- 92-99: 65.73%
→ min: 33.95% (Greece); max: 100% (Germany)
- 00-04: 66.35%
→ min: 34.07% (Greece); max: 100% (Finland)

2. Application: results – Overall performance changes

Median over all (24) countries:

- From (81-91) to (92-99): + 24.87%
→ min: - 12.31% (Spain); max: + 170.78% (Portugal)
- From (92-99) to (00-04): + 00.06%
→ min: - 39.72% (Netherlands); max: + 53.17% (New Zealand)

Median over (15) EU countries:

- From (81-91) to (92-99): + 23.00%
→ min: - 12.31% (Spain); max: + 170.78% (Portugal)
- From (92-99) to (00-04): + 00.00%
→ min: - 39.72% (Netherlands); max: + 21.60% (Finland)

2. Application: results – Catching up

Median over all (24) countries:

- From (81-91) to (92-99): + 19.21%
→ min: - 41.46% (Spain); max: + 102.74% (Austria)
- From (92-99) to (00-04): + 01.08%
→ min: - 30.82% (Switzerland); max: + 52.14% (Belgium)

Median over (15) EU countries:

- From (81-91) to (92-99): + 18.93%
→ min: - 41.46% (Spain); max: + 102.74% (Austria)
- From (92-99) to (00-04): + 02.93%
→ min: - 28.00% (Spain); max: + 52.14% (Belgium)

2. Application: results – Environmental change

Median over all (24) countries:

- From (81-91) to (92-99): + 14.23%
→ min: - 08.47% (New Zealand); max: + 64.46% (Belgium)
- From (92-99) to (00-04): - 02.91%
→ min: - 25.27% (Belgium); max: + 11.64% (New Zealand)

Median over (15) EU countries:

- From (81-91) to (92-99): + 18.55%
→ min: - 00.16% (Ireland); max: + 64.46% (Belgium)
- From (92-99) to (00-04): - 06.65%
→ min: - 25.27% (Belgium); max: + 07.33% (Finland)

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3. Conclusions

- Methodology for evaluating performance changes
 - ... including decomposition in terms of catching up and environmental change effects
 - ... using endogenous (benefit-of-the-doubt) weighting
 - Illustration for Knowledge Based Economy, by comparing EU and non-EU (OECD) countries
 - Refinements:
 - Include weight restrictions
 - Check robustness w.r.t. sample selection, variable selection, weight restrictions, ...
- Cf. JRC-KUL (2006), Center for Economic Studies (CES) Discussion Paper 06.03