Innovation, Growth and Competitiveness

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Based on

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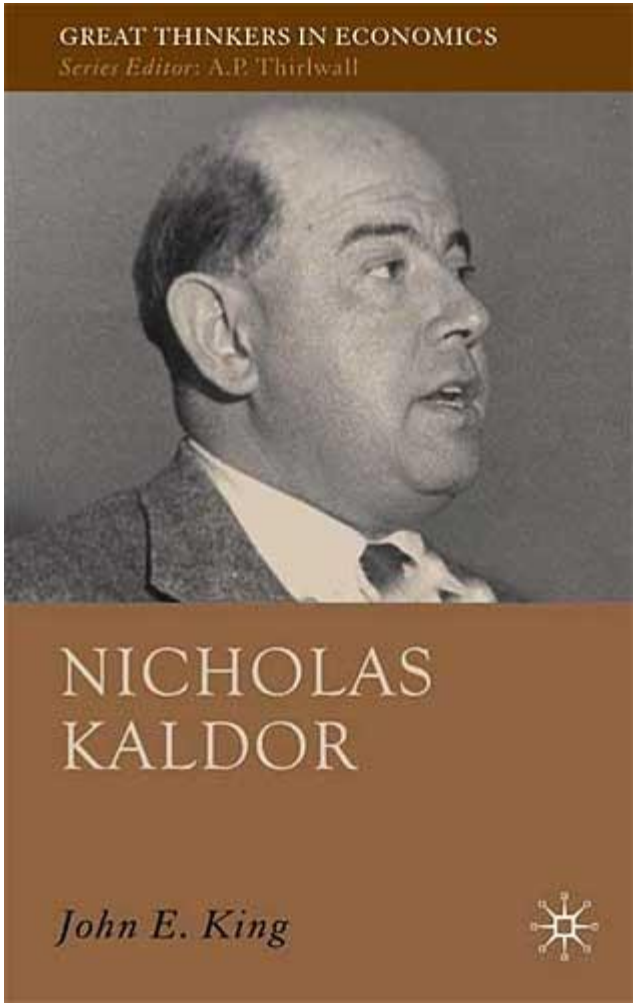
What is the competitiveness (of a country)?

- ”the degree to which, under open market competition, a country can produce goods and services that meet the test of foreign competition while simultaneously maintaining and expanding domestic real income” (OECD, 1992)
- ”The only meaningful concept of competitiveness at the national level is productivity (…) If a nation loses the ability to compete in a range of high-productivity/high wage industries, its standard of living will be treathened” (Porter, 1990)
- Growth and trade: The external constraint matters….

Explaining competitiveness



- Cost competitiveness questioned: the "**Kaldor paradox**"(1978)
- Thirlwall (1979): The **external constraint**, cost competitiveness and "non-price factors" (**income elasticities**)
- Kaldor (1981) : "**non-price factors**" cannot be taken for granted, but needs to be explained.
- Fagerberg (1988): "non-price factors" reflect the **ability to develop & exploit technology**

A simple Schumpeterian growth model

Assume that the GDP of a country (Y) is a function of its **technological knowledge** (T) and its **capacity for exploiting the benefits of knowledge** (C):

$$Y = f(T, C)$$

The technological knowledge is a function of knowledge (or innovation) created in the country (N) and knowledge diffused to the region from outside (D):

$$T = h(N, D)$$

The diffusion of external knowledge follows a logistic curve (d), where T_*^{cap} and T_i^{cap}, represent the frontier country and the country under consideration, respectively:

$$d = \gamma - \gamma T^{gap} \qquad \left(T^{gap} = \frac{T_i^{cap}}{T_*^{cap}} \right)$$

Why do growth rates differ?

By differentiation and substitution we arrive at the following solution for growth of GDP, using small case letters for growth rates (e.g., $y = dY/Y$, etc.):

$$y = \gamma\, \varepsilon_{YT}\varepsilon_{TD} - \gamma\, \varepsilon_{YT}\varepsilon_{TD}\, T^{gap} + \varepsilon_{YT}\varepsilon_{TN} n + \varepsilon_{YC} c$$

Diffusion

Innovation

Capacity

where $\varepsilon_{YT} = \dfrac{\partial Y}{\partial T}\dfrac{T}{Y}$ refers to the partial elasticity of GDP with respect to technology (similar for other variables)

Model applied to cross country samples by Fagerberg (1987) and Fagerberg and Verspagen (2002) : All three factors matter, but imitation becomes harder through time, and importance of innovation increases

Including international trade . .

Assume that exports of a country (i) depend on four factors: its **technological competitiveness** (T), its **capacity to exploit technology** commercially (C), its **price competitiveness** (P) and **world demand** (W):

$$X = f(T, C, P, W)$$

Exports

where

$$T = \frac{T_i}{T_{world}}$$

$$C = \frac{C_i}{C_{world}}$$

$$P = \frac{P_i}{P_{world}}$$

Since imports in this model are the "world's" exports – inverse of the equation above with domestic demand (Y) replacing world demand, we get:

$$M = g\left(\frac{1}{T}, \frac{1}{C}, \frac{1}{P}, Y\right)$$

Imports

Linking trade & growth: The external constraint

If we assume that trade is in balance, we get:

$$XP = M$$

Finally consider as earlier that technology depends on both national sources (*N*) and diffusion (*D*) from abroad, and that the latter follows a logistic curve. By totally differentiating, substituting and rearranging, the following solution for growth of GDP follows:

$$y = \gamma\,\varepsilon_{TD}\frac{\varepsilon_{XT}+\varepsilon_{MT}}{\varepsilon_{MY}} - \gamma\,\varepsilon_{TD}\frac{\varepsilon_{XT}+\varepsilon_{MT}}{\varepsilon_{MY}}T^{gap} + \varepsilon_{TN}\frac{\varepsilon_{XT}+\varepsilon_{MT}}{\varepsilon_{MY}}n + \frac{\varepsilon_{XC}+\varepsilon_{MC}}{\varepsilon_{MY}}c + \frac{\varepsilon_{XP}+\varepsilon_{MP}+1}{\varepsilon_{MY}}p + \frac{\varepsilon_{XW}}{\varepsilon_{MY}}w$$

Diffusion Innovation Capacity Price Demand

which reminds us about the simple Schumpeterian growth model …

Conclusion from the model: Growth = Catch-up potential + Competitiveness

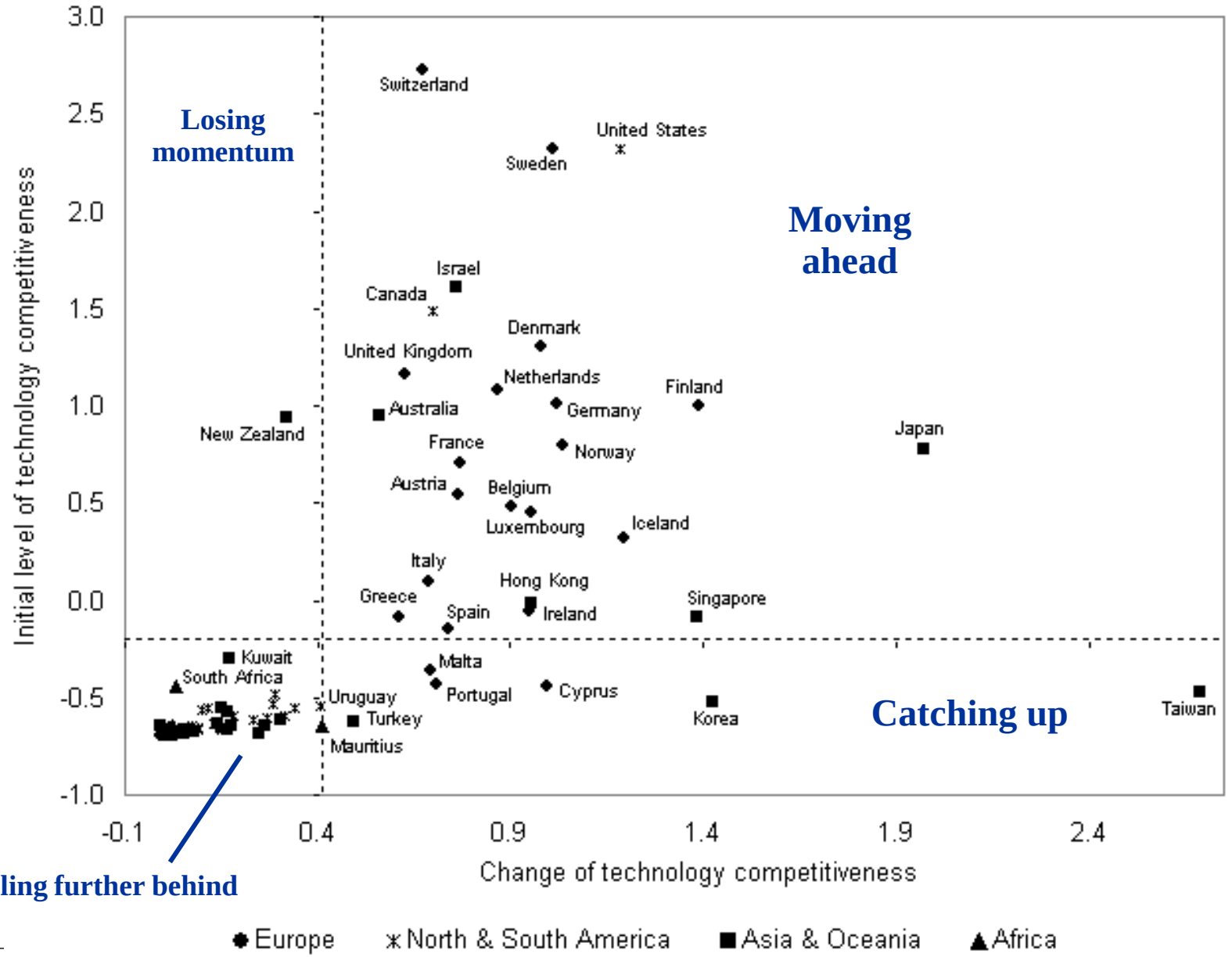
HOW to measure:

- Technology: **R&D, patents, publications and ICT infrastructure**
- Capacity: **Education, governance, financial system**
- Price: **Growth in unit labour cost**
- Demand: **Growth of world demand weighted by export composition**

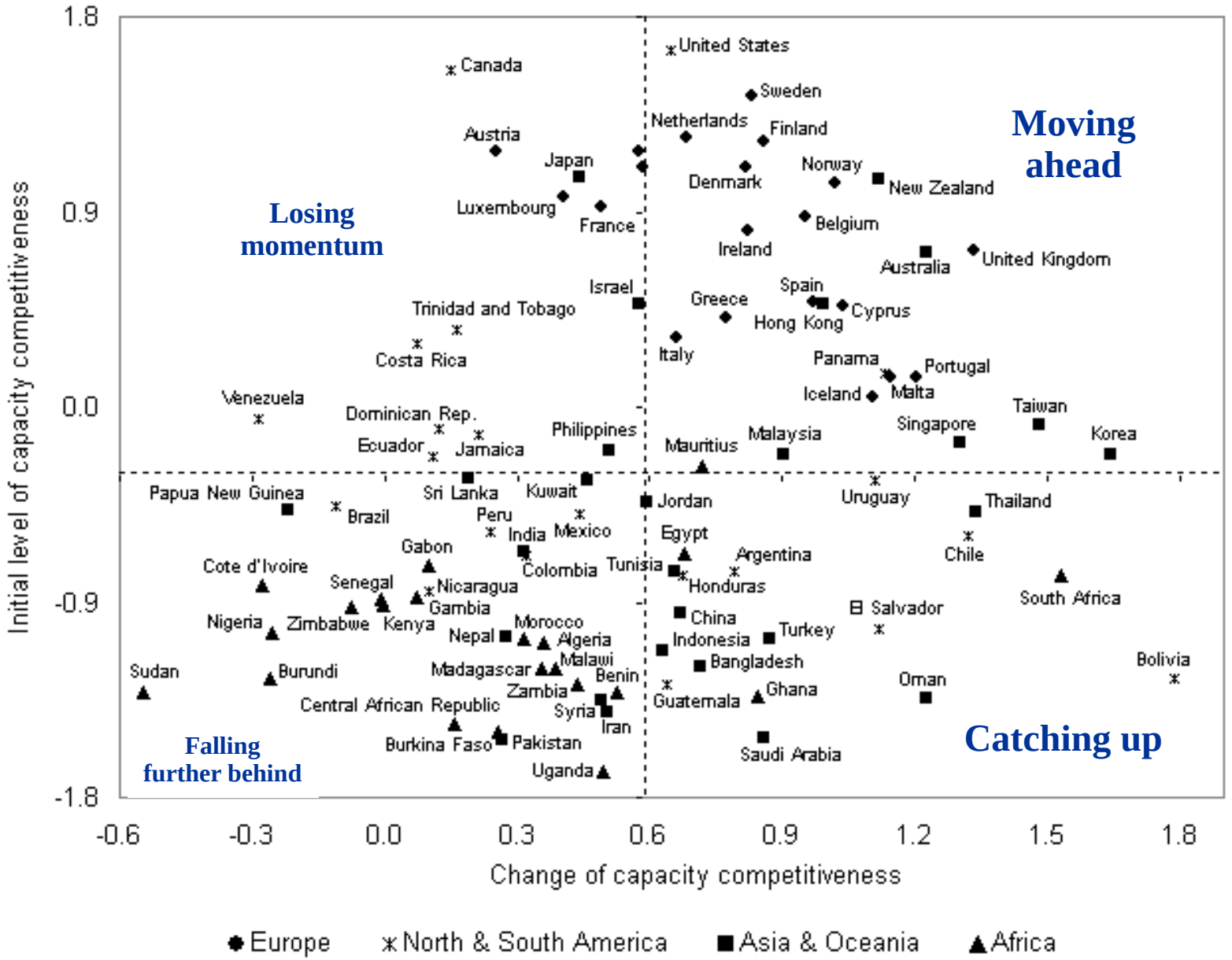
WHAT to measure:

- **Technology Competitiveness**: Creation of new knowledge (technology) in the country (innovation) relative to that of competitors.
- **Capacity Competitiveness**: Growth in the capacity to exploit knowledge, independently on where it is created, relative to that of competitors.
- **Price Competitiveness**: Change in relative prices in common currency
- **Demand Competitiveness**: Growth of world demand weighted by the ratio between the income elasticity for exports and that of imports *(Thirlwall – Kaldor)*

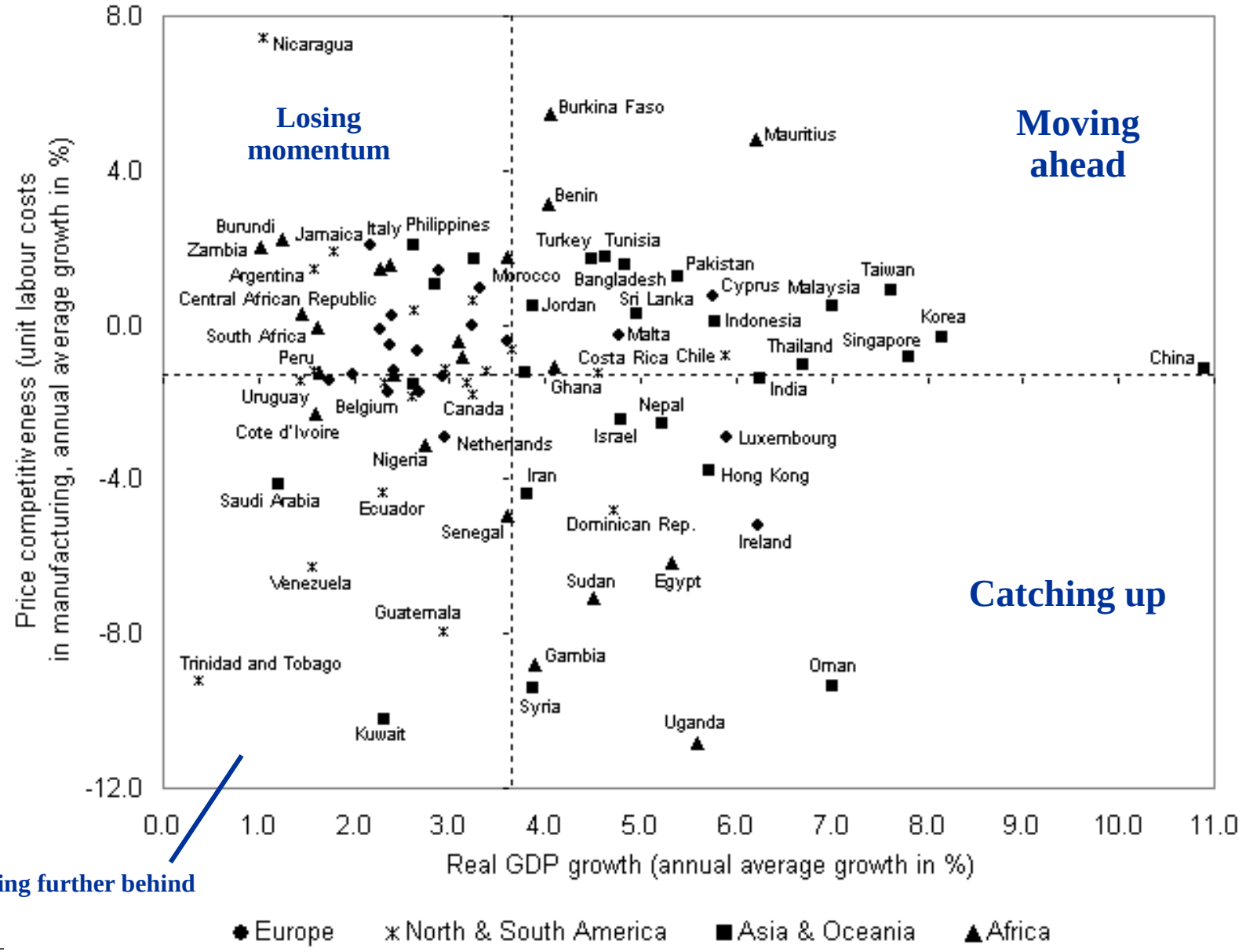
Technology Competitiveness: 1980-2002



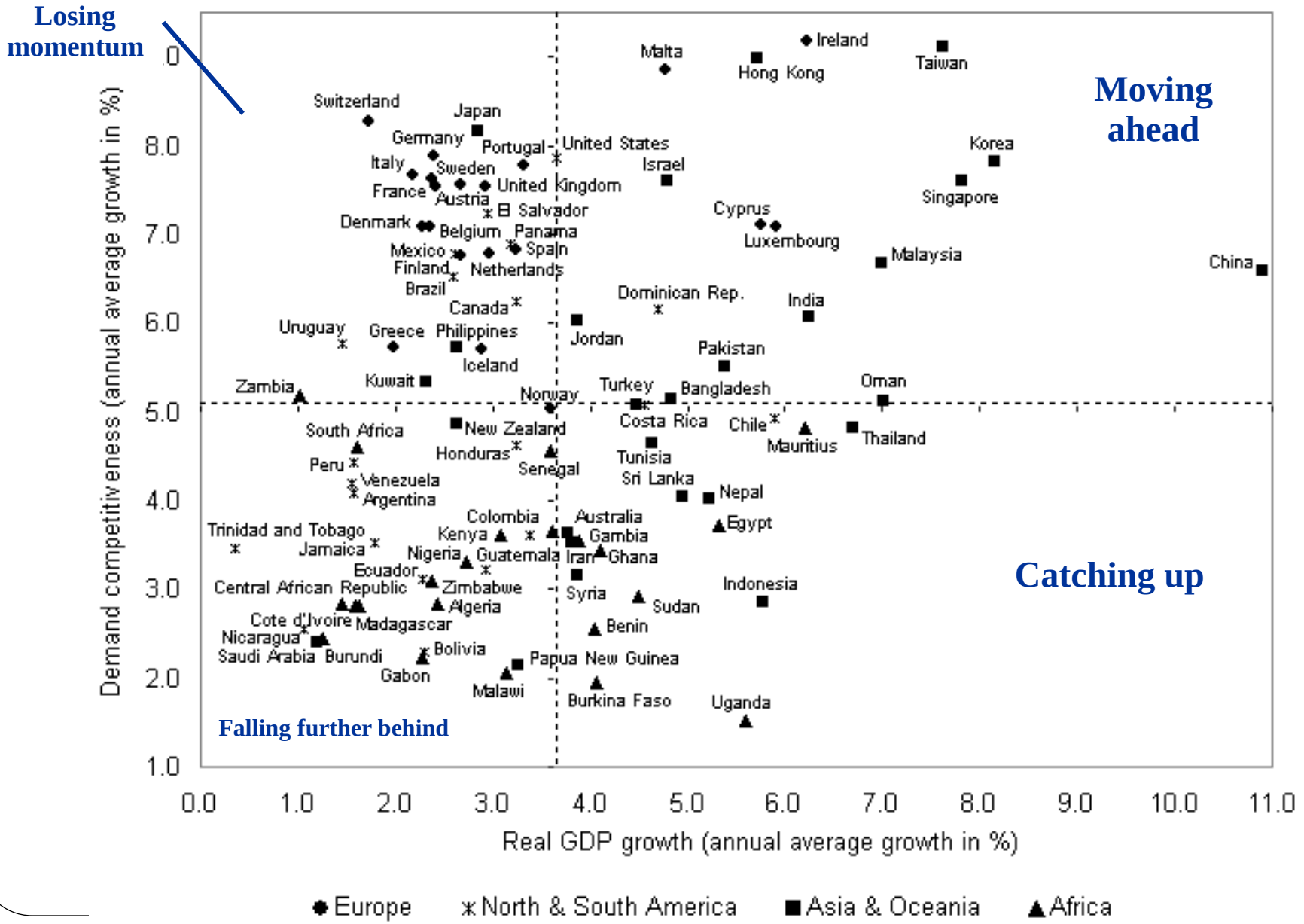
Capacity Competitiveness: 1980-2002



Price Competitiveness: 1980-2002



Demand Competitiveness: 1980-2002



Explaining growth:
90 countries, 1980-2002

	OLS	*Iteratively re-weighted least squares*	*OLS Excluding outliers*
Constant	..	-0.02	0.002
	..	(0.28)	(0.03)
Log of the initial GDP per capita	-0.79***	-0.76***	-0.82***
	(6.24)	(6.86)	(8.45)
Technology	0.31***	0.31**	0.41**
	(2.65)	(2.39)	(2.61)
Capacity	0.33***	0.33***	0.36***
	(3.14)	(3.55)	(3.90)
Price	-0.19***	-0.18**	-0.18***
	(2.62)	(2.19)	(3.99)
Demand	0.41***	0.35***	0.31***
	(3.02)	(2.82)	(3.22)
F-test	14.50	12.93	19.66
R^2	0.46	..	0.53
Observations	90	90	80

Analyzing the dynamics: Lessons

- High explanatory power, robust results
- Potential for diffusion is important, but conditional on:
  - **Technology competitiveness**
  - **Capacity competitiveness**
  - Price competitiveness
  - **Demand competitiveness**
- Some countries disadvantaged by factors related to geography, history and nature
- «Virtuos» and «Vicious» «circles»: Self-reinforcing processes caused by feedbacks from growth on technology and capacity (Fagerberg 1988; endogenous capacity)
- What is the relevance with respect to the current crisis?