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From imitation to innovation: the BRICS

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UNIDO

Stages of Technological Learning

- Kim (1997) distinguish three stages of technological learning
- Duplicative imitation: reverse engineering (BRIS?)
 - Education
 - Technology transfer
 - Chaebols
 - Personnel mobility
- Creative imitation: improving features on foreign products (C?)
 - Technology transfer
 - Reverse brain drain
 - Corporate R&D
 - Universities
 - Government Research Institutes
- Original innovation: new products

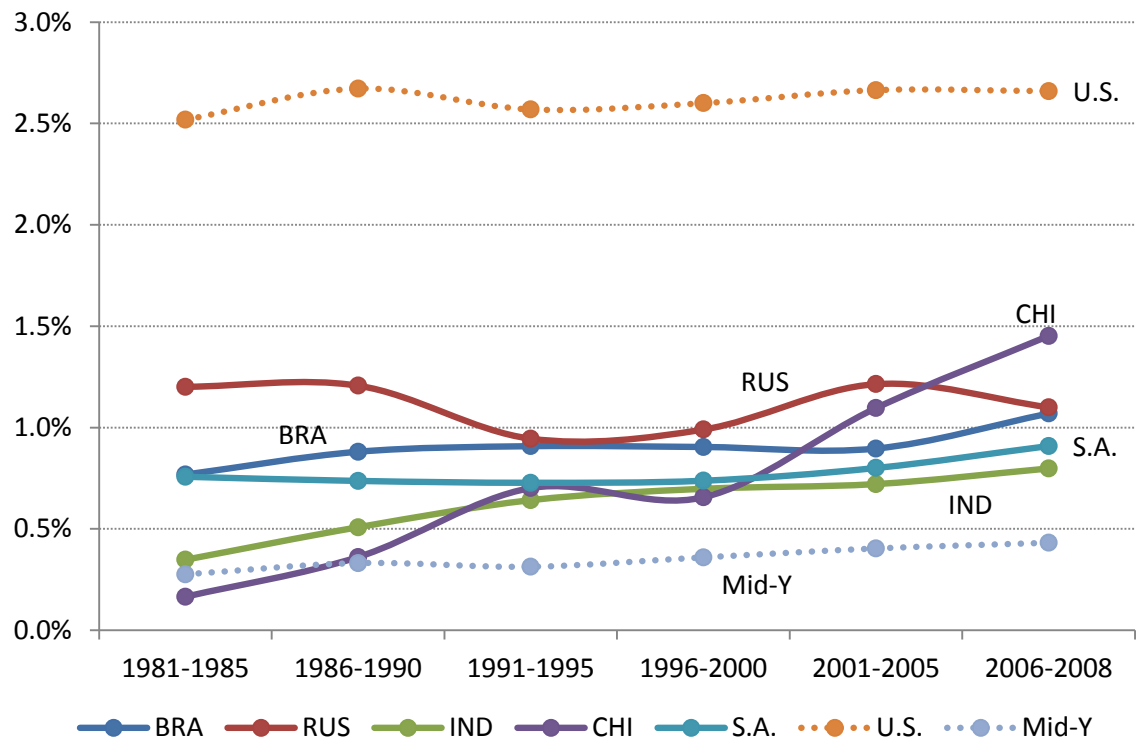


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The New Guys in the Block

BRICS: R&D expenditures

Figure 1. R&D expenditures as % of GDP (5 year averages).
BRICS countries, Middle-Income countries and US. 1980-2010

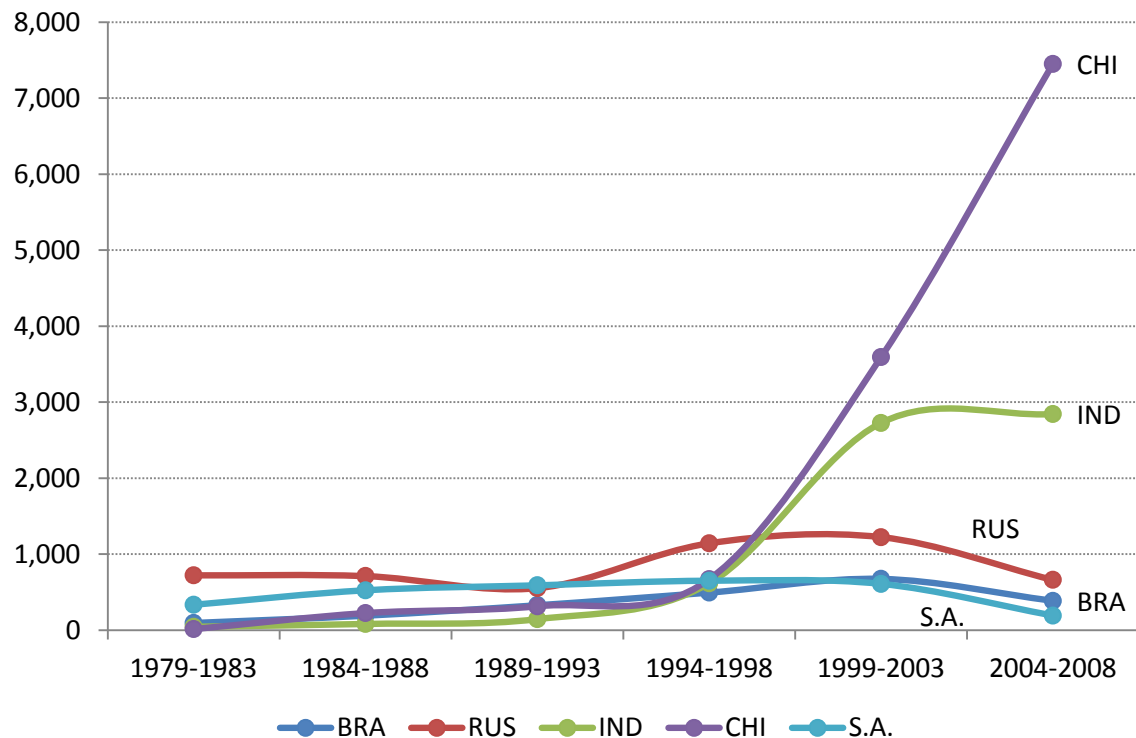


- Between 1980 and 2008, all BRICS (except Russia) increase R&D expenditures as % of GDP.
- R&D intensity is higher than (non-BRICS) Middle-Income average.
- The most dramatic increased is found in China.
- Still, R&D intensity is substantially lower than US.

Source: UNIDO (2012)

BRICS: Patents

Figure 2. Number of Patents granted in the USPTO (5 year sum). BRICS countries, 1979-2008.

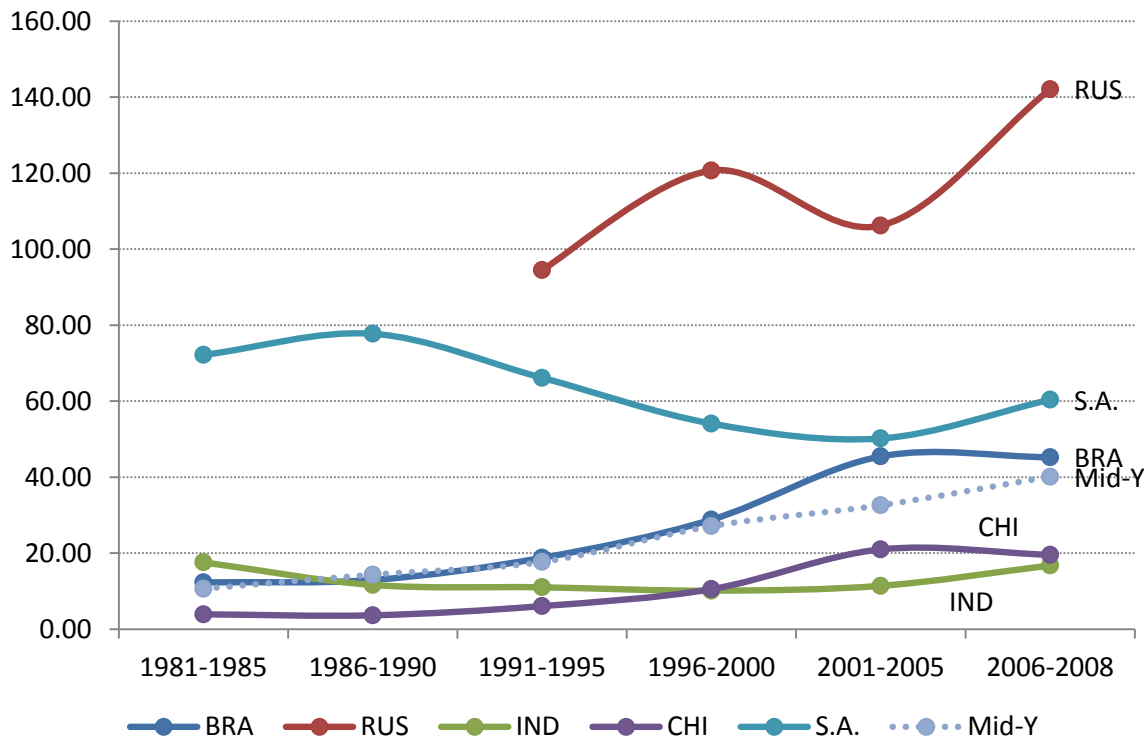


- *In terms of patents, China – and to a lesser extent, India – also show remarkable achievements.*
- *Russia, Brazil and South Africa have seen a decline in patents since 2000.*
- *South Africa is the worst performer.*

Source: UNIDO (2012)

BRICS: Papers

Figure 4. Number of scientific and engineering articles per million of inhabitants (5 year averages in the BRICS and average middle-income country, 1981-2008)



- With the exception of South Africa, all BRICS increased the per capita number of publications.
- Russia stands out by far as the most productive country in this respect.
- China and India contribute very large numbers of papers in absolute terms, but given their large populations, the per capita results are low.

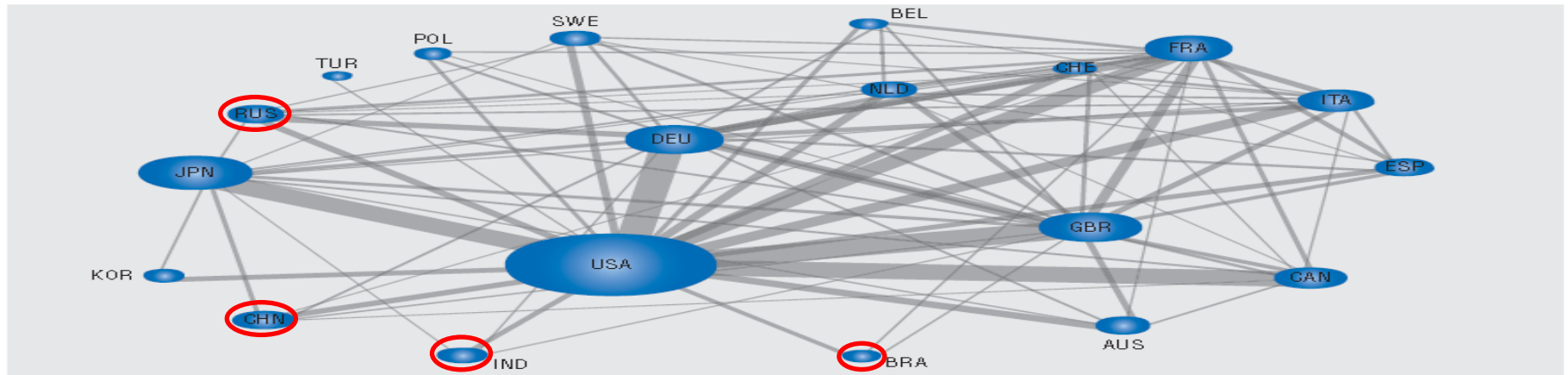
Source: Naudé et al. (2012) [Background paper for UNIDO (2012)]

BRICs: Collaborations

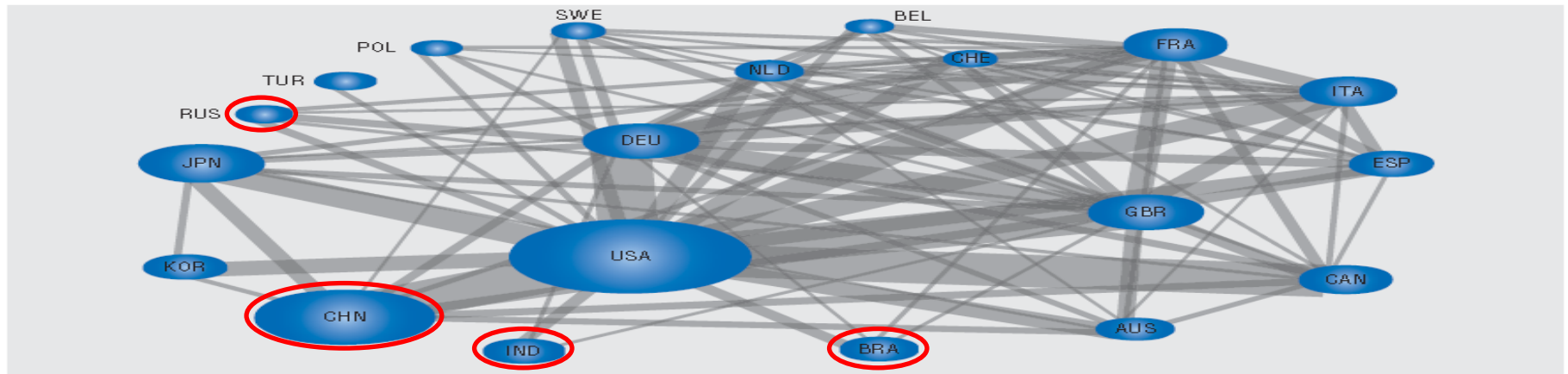
Scientific articles and co-authorship, 1998 and 2009

Numbers based on whole counts

1998



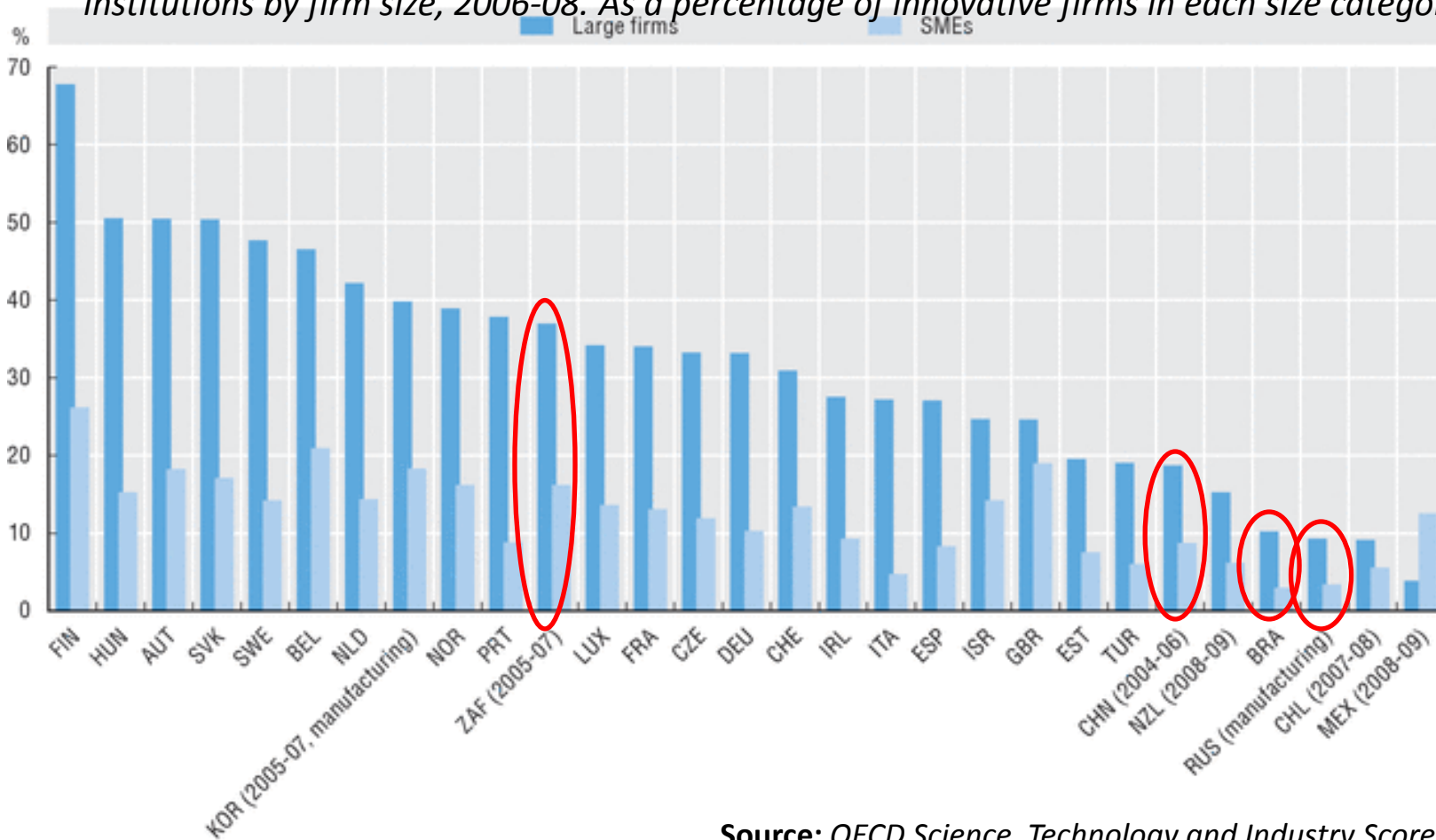
2009



Source: OECD, calculations based on Scopus Custom Data, Elsevier, December 2010.

BRCs: Collaborations

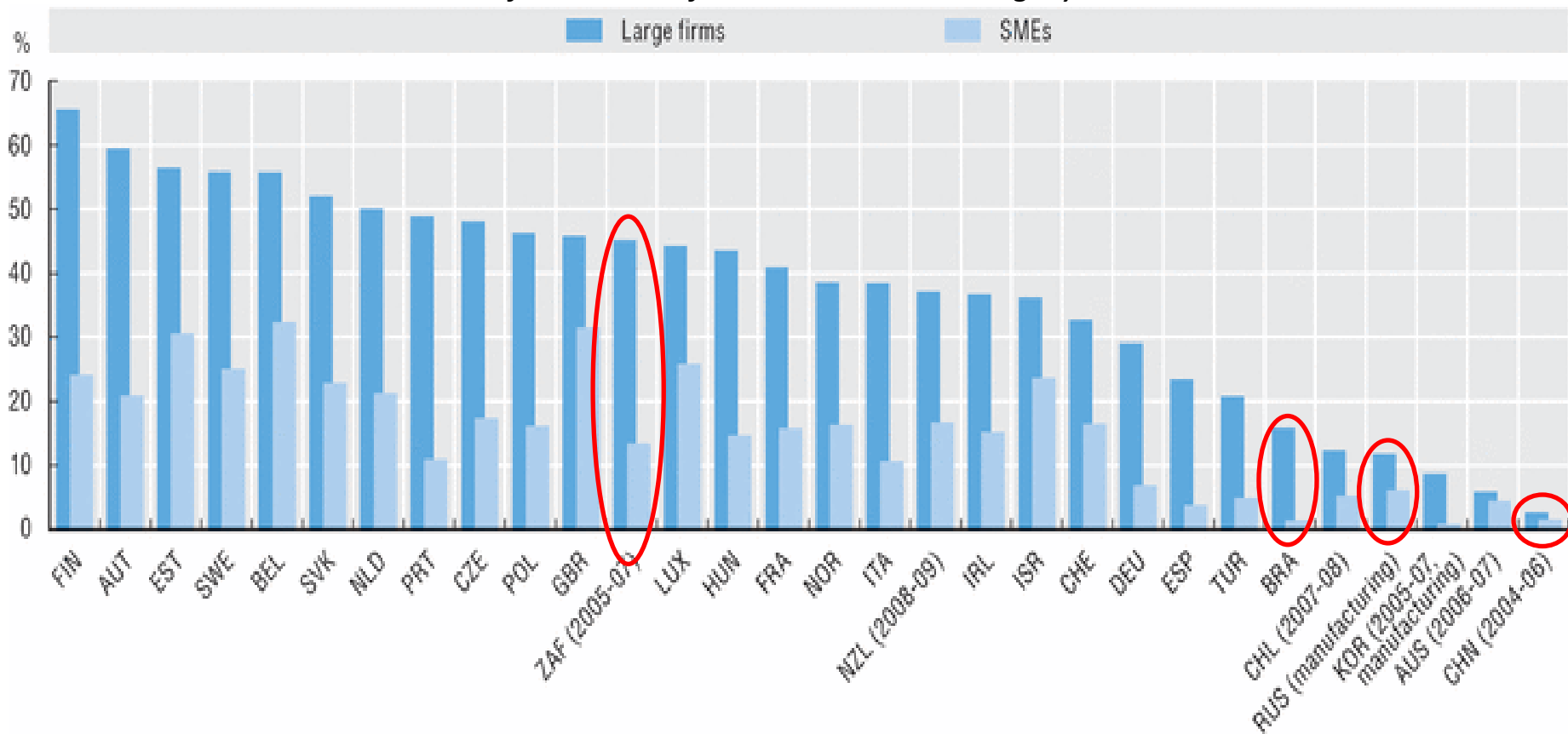
Figure 5. Firms collaborating on innovation with higher education or government research institutions by firm size, 2006-08. As a percentage of innovative firms in each size category



Source: OECD Science, Technology and Industry Scoreboard

BRCs: Collaborations

Figure 6. Firms engaged in international collaboration by firm size, 2006-08. As a percentage of innovative firms in each size category



Source: OECD Science, Technology and Industry Scoreboard

Challenges to Technological Learning

- Duplicative Imitation
 - Balance and performance
 - Informal learning and value chain participation
 - Technological champions
 - Foreign expertise and inter-company mobility
 - Sense of urgency
- Creative Imitation
 - Creative university learning
 - Technological acquisition
 - Accelerate return of professionals
 - Shift R&D to the firm, particularly small
 - Interface with firm R&D: applied research centres and foreign firms
 - Environmental sustainability