National Innovation systems and global innovation networks

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Why the report?

- Global collaborative innovation networks are essential for the creation, transfer and absorption of new knowledge and ultimately economic growth.
- These networks are located within several different countries, with their own national innovation system.
- Objectives:
  - Why are national innovation systems important?
  - Are GPNs evolving into GINS?

Organization of the report

- Introduction: National Innovation systems and global innovation networks
  - Conceptual Chapter
- National Innovation Systems and Globalized Innovation Networks from a comparative perspective
  - Comparative empirical chapter
- Country chapters: Germany, UK, Denmark, Norway, Sweden, Estonia, China, India, Brazil and South Africa
  - Use the term CIBS to cover China, India, Brazil and South Africa – From UNU-WIDER.

Conclusion 1

- National innovation systems remain important for the development of global innovation networks.
  - Networks make it possible to transcend national boarders, but they do not replace the institutional arrangements that support the national innovation system.
  - Some global networks are planned on a large scale, usually by large MNEs
  - Others evolve in a self-organizing way, containing individual collaborative agreements

Conclusion 2

- China and India appear to be moving on a path of economic growth that will close the productivity gap over time and that they are becoming increasingly involved in GPNs and GINs.
- It is less clear that Brazil and South Africa are on the same path of economic growth, but there is evidence that they are getting increasingly involved in the global networks.
- The EU as a whole is not disconnected from GINs and that the relatively higher productivity levels that the United States has may be misleading.
  - Both the United States and Europe are in many of the same networks.

Policy conclusions

- The emerging economies need to develop the institutional arrangements that facilitate the creation of global knowledge networks and integrate them into their innovation systems.
- There is the need to consider carefully what specific policies can encourage EU firms to create and benefit from an increased number of GINs with the emerging developing economies (CIBS).

The conceptual chapter

- Technology gaps and knowledge flows
- National Innovation Systems
- Social systems of production
- Production, technology and fragmentation
- Technological collaboration and innovation networks
- International technology transfer networks
- The role of multinational enterprises in global innovation networks
- The role of strategic alliances in global innovation networks
- Outline of the report

National Innovation Systems

- *Freeman (1987)* defines NIS as the ***network of public and private institutions*** whose activities and interactions initiate, import, modify and diffuse new technologies.
- *Freeman (1991)* defines a ***networks of innovators*** as knowledge flows both within and between enterprises and organizations, irrespective of national borders, but also part of the national institutional arrangements underlying the NIS.
- *Lundvall (1992)* defines ***interactive learning*** as elements and relationships, which interact in the production diffusion and use of new and economically useful knowledge . . . either located within or rooted inside the borders of a nation state.

Social systems of production and technology specialization

- It is useful to think of the ***social system of production*** as being different from, yet complementary to the ***technical structure of production*** (Löwe, 1965).
  - Technology and social relations / structure and behaviour
  - Granovetter's (1985) idea that economic relations between individuals or firms are embedded in social networks.
- One of Adam Smith's great insights was that ***cooperative production*** increases productivity.
  - ***Greater specialization*** in enterprises entails greater inter-dependencies between enterprises, including networking, collaboration, and outsourcing (Nooteboom, 2007).
  - Increased specialization also lead to fragmentation which encourages ***interactive learning*** through GPNs and GINs.

GINs can be formal or informal

- ***Networks of innovators*** (Freeman, 1991)
  - Innovation networks can be more ***formal*** and ***rigid***, often including a collaborative agreement or strategic alliance.
  - They can also be ***informal***, ***flexible*** and ***trust-based*** relations, often linking enterprises with various local actors.
- Some GINs are ***coordinated from central location*** (Porter), usually by a MNE.
- Other GINs evolve in a ***self-organizing way***, often containing ***individual collaborative agreements*** that include cross-licensing, outsourcing, joint ventures and R&D agreements, research associations, (inter-)governmental research programs and other types of innovative activities (Imai and Baba, 1991).

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Members or network nodes can be MNCs or local SMEs!

Some characteristics of GINs

- Innovation collaboration is central to each GIN, but it may or may not involve R&D activity.
- MNEs are often at the center of each GIN.
  - This is because the parent and its affiliates are often networked.
- But many of its members or nodes enter into strategic alliances or strategic partnerships
- International technology transfer is important to each GIN, often including trade in goods, services and property rights.
- Innovation networks are key for emerging technologies, and includes both pioneers and adopters.
- They can be regionally oriented and depend on professional inter-organizational networks.

National Innovation Systems and Globalized Innovation Networks in Comparison

- The relative importance of the CIBS countries
- The globalization of R&D and the rise of GINs
- Competencies, capabilities and learning in comparative perspective
- Knowledge flows and GINs between Europe and the CIBS countries
- Technological collaboration and GINs
- From GPNs to GINs

The relative importance of the CIBS countries

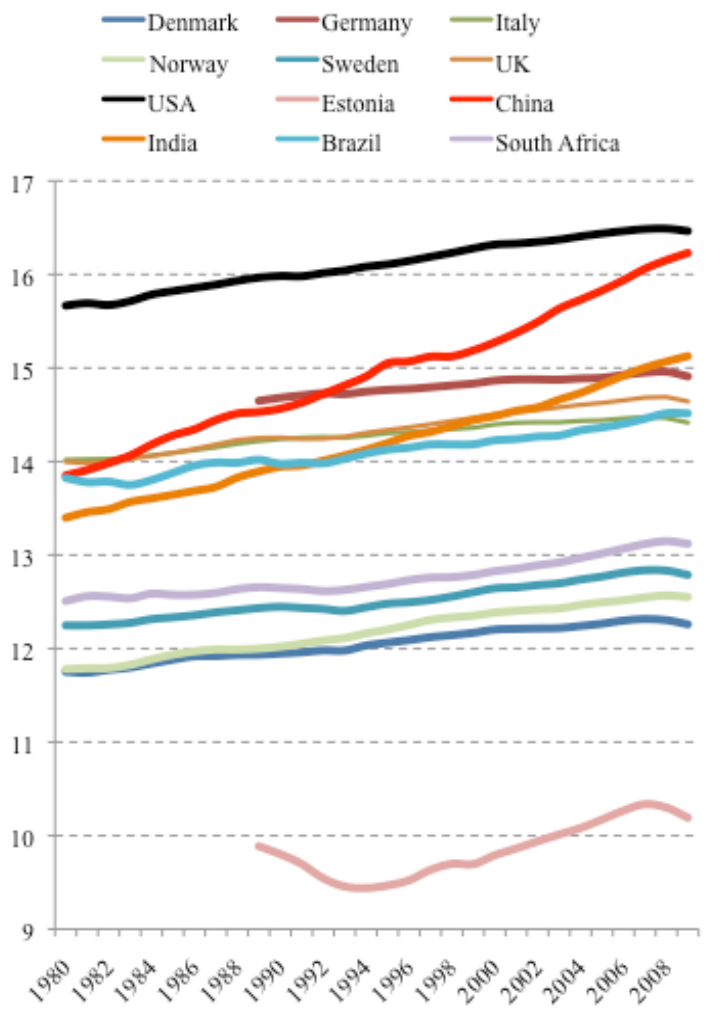
- CIBS innovate mainly by learning the use and improvement of technologies that already exist in the relatively more advanced industrial economies.
  - Building social and firm capabilities were essential in every case of catching-up this century.

Evolution of world population and world GDP, and per capita GDP, 1820-2001

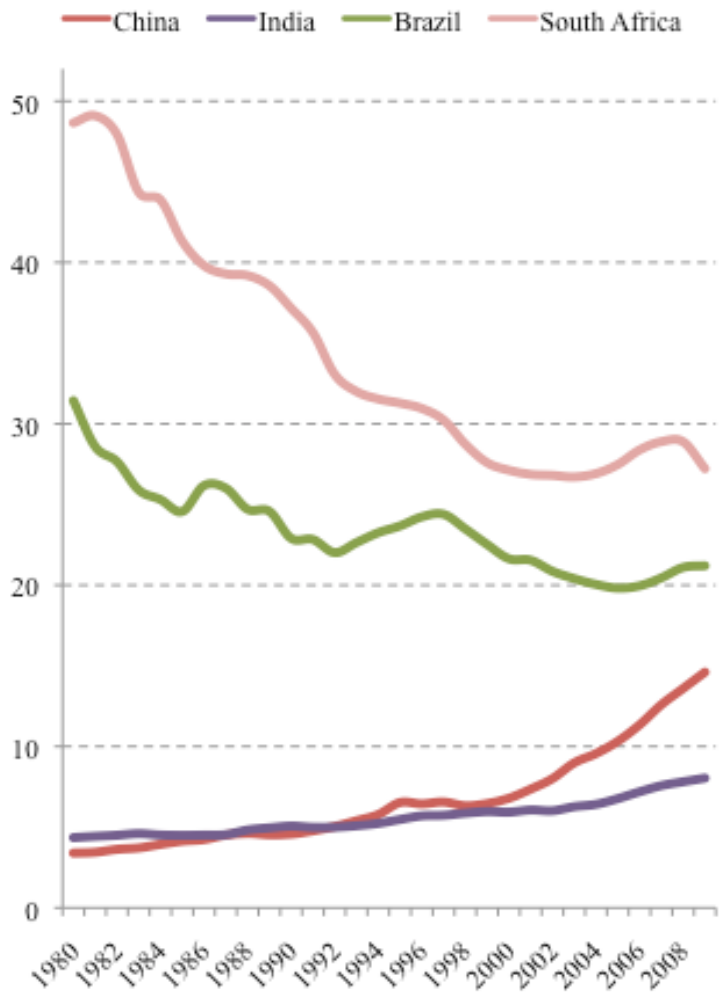
	1820	1870	1913	1950	1973	2001
Percentage share of world population						
Western Europe	11.0	12.8	12.7	10.2	7.7	5.3
United States	1.0	3.2	5.4	6.0	5.3	4.6
China	36.6	28.1	24.4	21.7	22.5	20.7
India	19.9	17.0	14.2	14.8	14.8	16.5
Brazil	0.4	0.8	1.3	2.1	2.6	2.9
South Africa	0.1	0.2	0.3	0.5	0.6	0.7
Percentage share of world income						
Western Europe	20.5	30.5	30.8	24.1	22.8	17.5
United States	1.8	8.8	18.9	27.3	22.1	21.4
China	32.9	17.1	8.8	4.5	4.6	12.3
India	16.0	12.1	7.5	4.2	3.1	5.4
Brazil	0.4	0.6	0.7	1.7	2.5	2.7
South Africa	0.1	0.2	0.4	0.6	0.6	0.5

Evolution of GDP and labour productivity (per person employed -2009 USD)

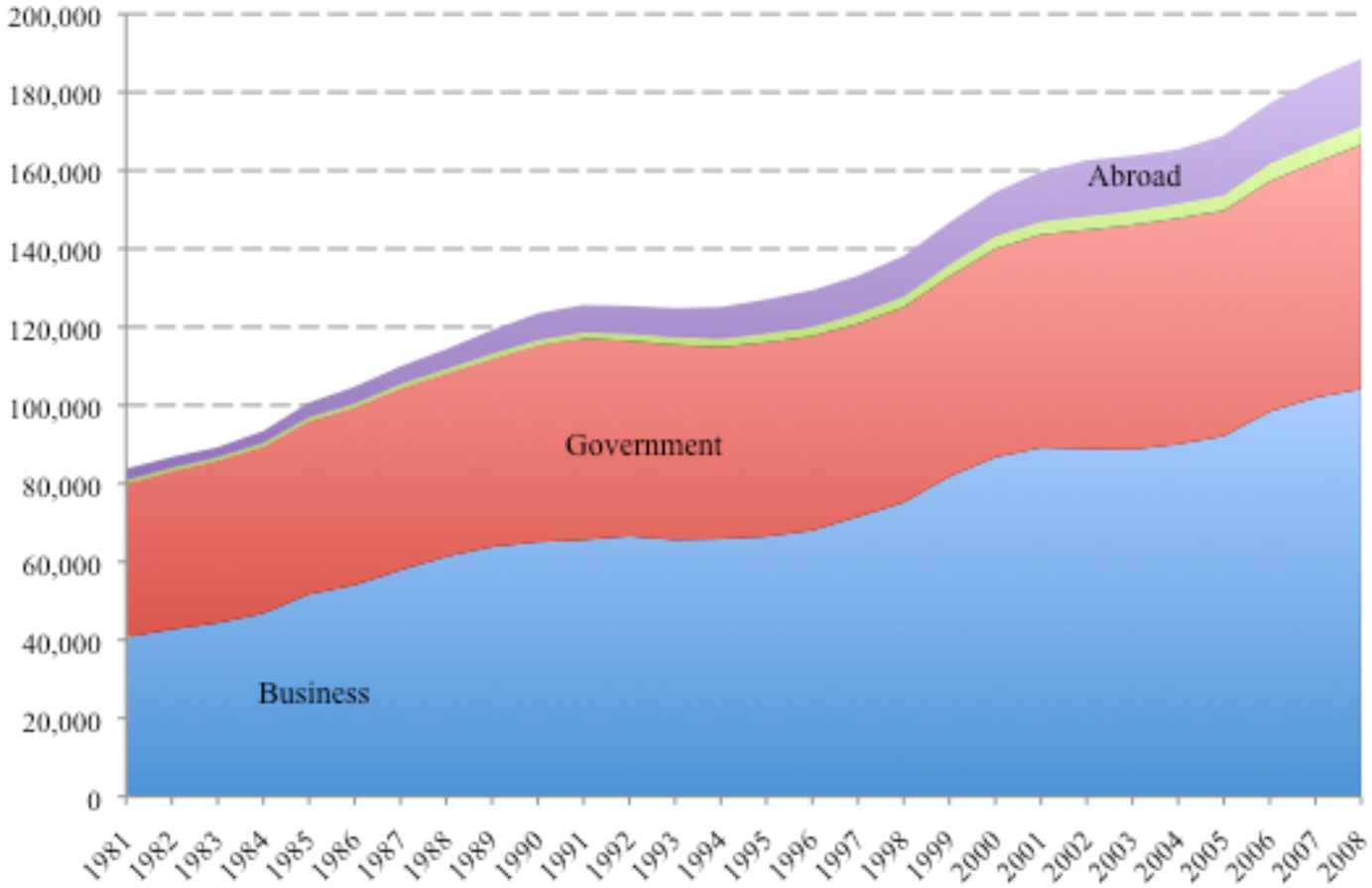
Log GDP



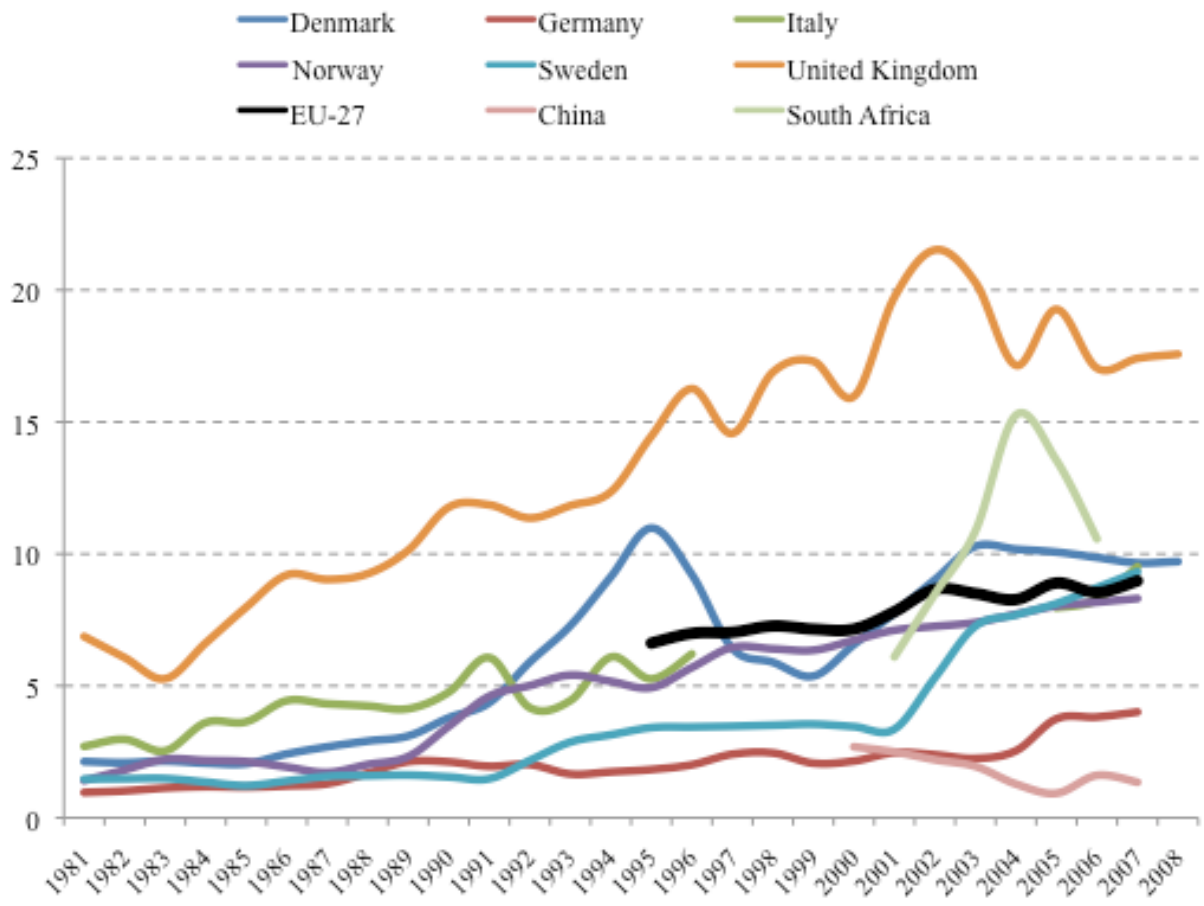
Labour productivity relative to the US



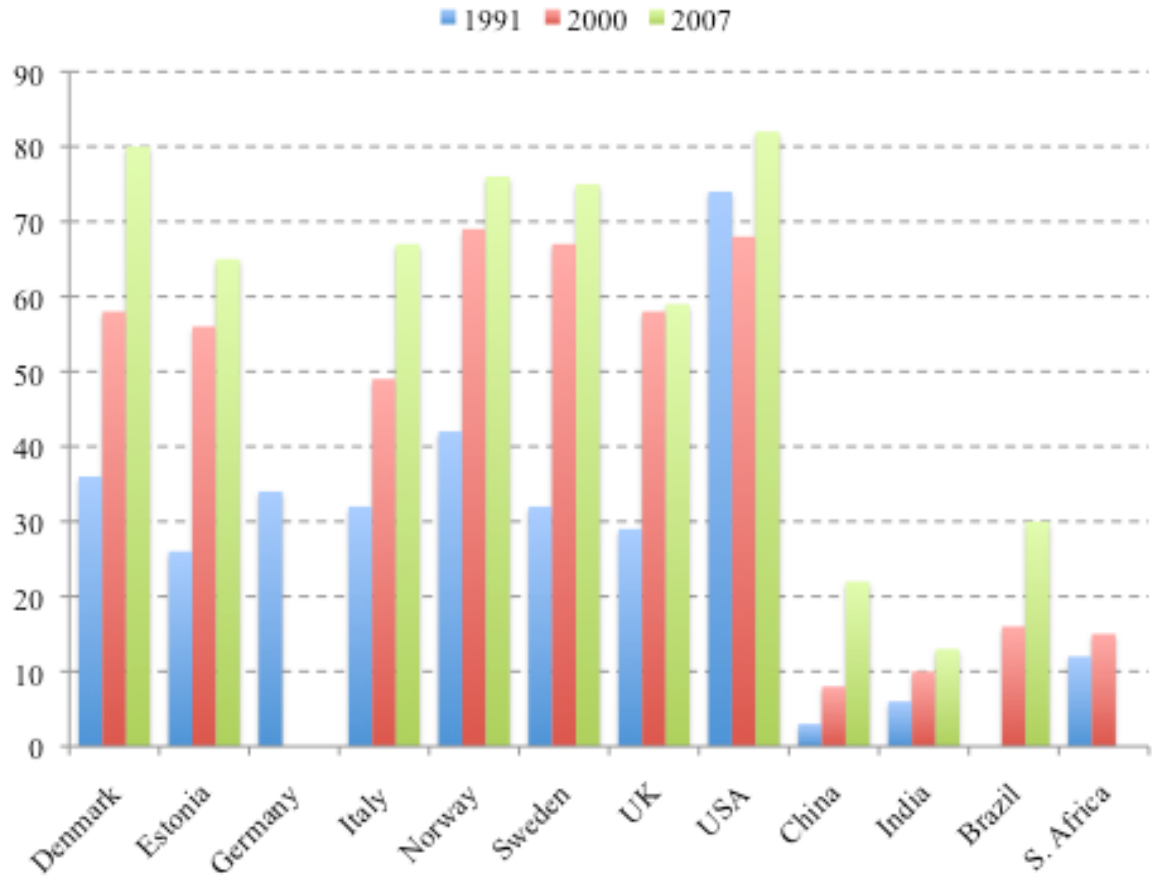
R&D by source of financing in the original 15 EU Member States



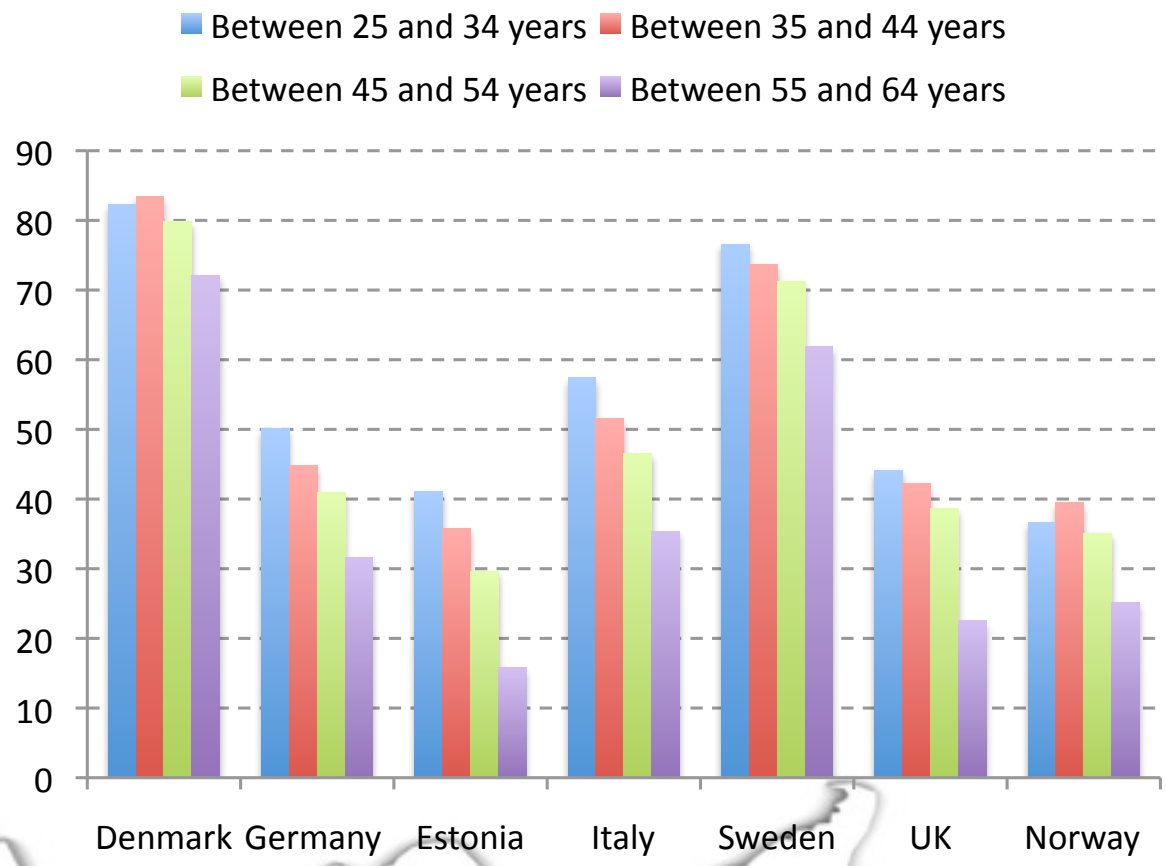
Percentage of GERD financed abroad



School enrollment, tertiary (percentage gross)



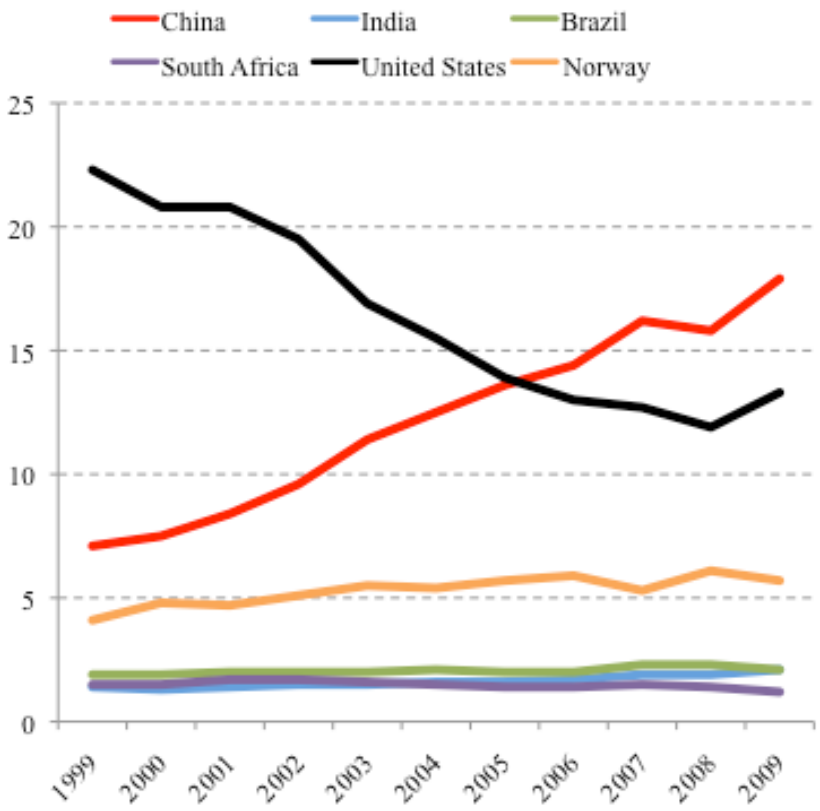
Participation in life long learning activities, 2007

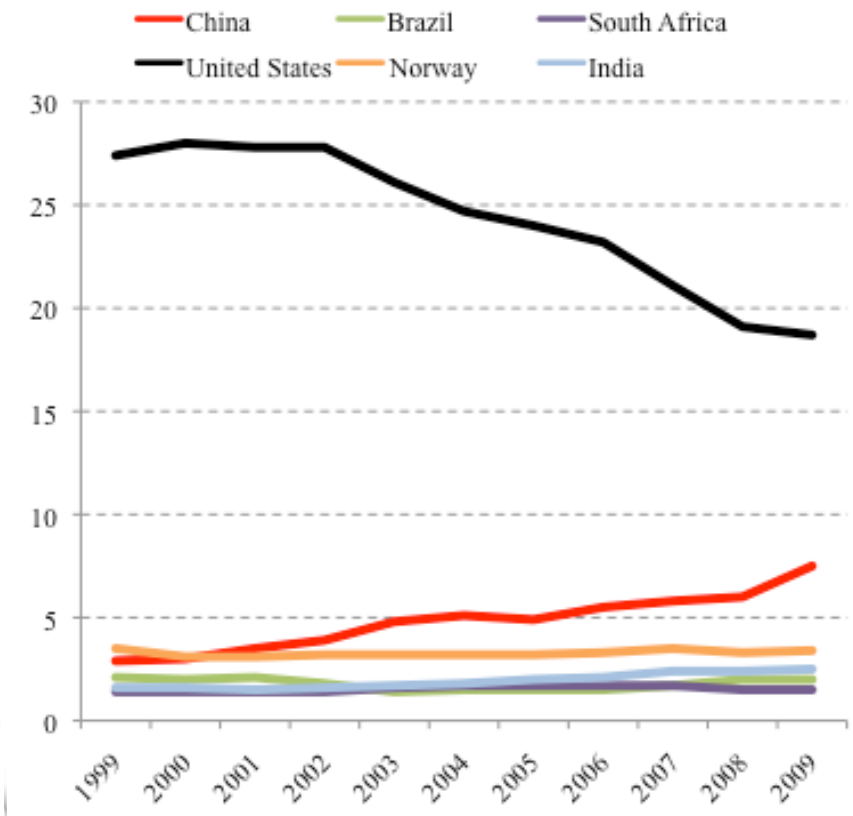


Knowledge flows and global networks between Europe and the CIBS countries

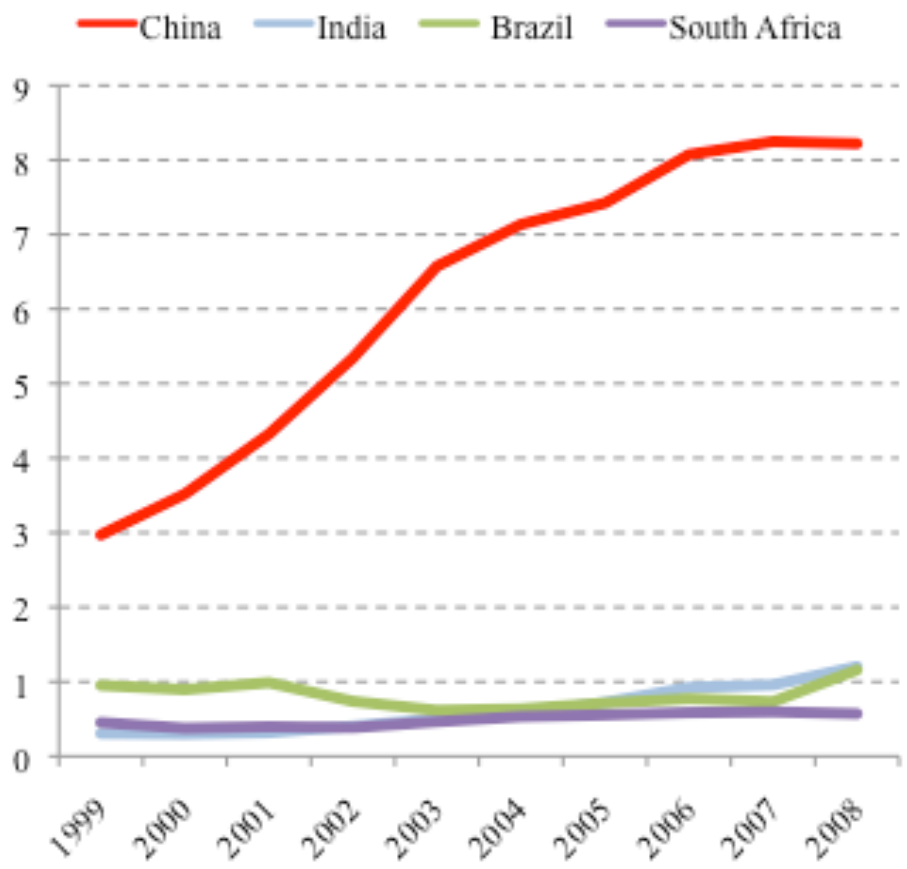
- Global knowledge flows are important for countries below the technology frontier.
- Reverse flows will increase as countries approach the frontier.
- Own R&D efforts complement technological knowledge obtained from abroad
- Five channels of technology transfer
  - Trade in goods; trade in business services; FDI; technology licensing; Researcher mobility

Share of imports and exports by partner (% of EU27 trade)



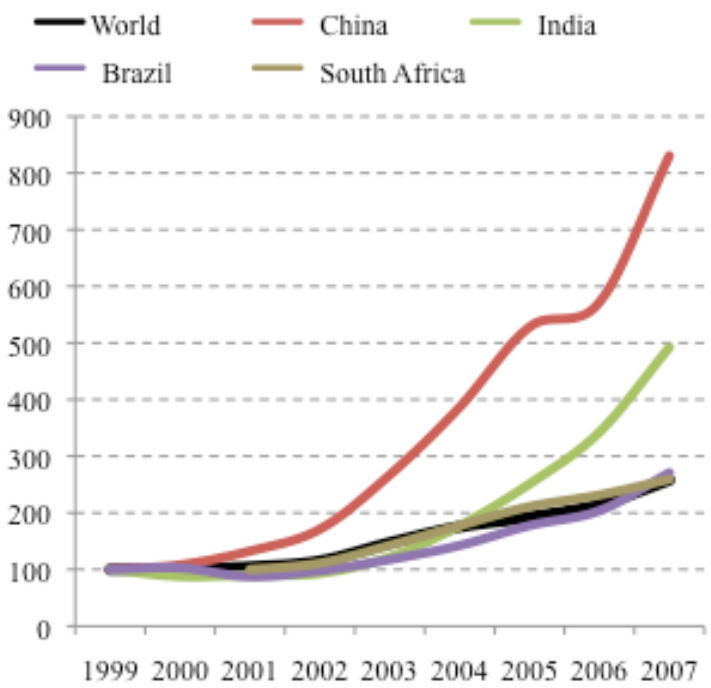


Imports of machinery & equipment (percentage of global market)

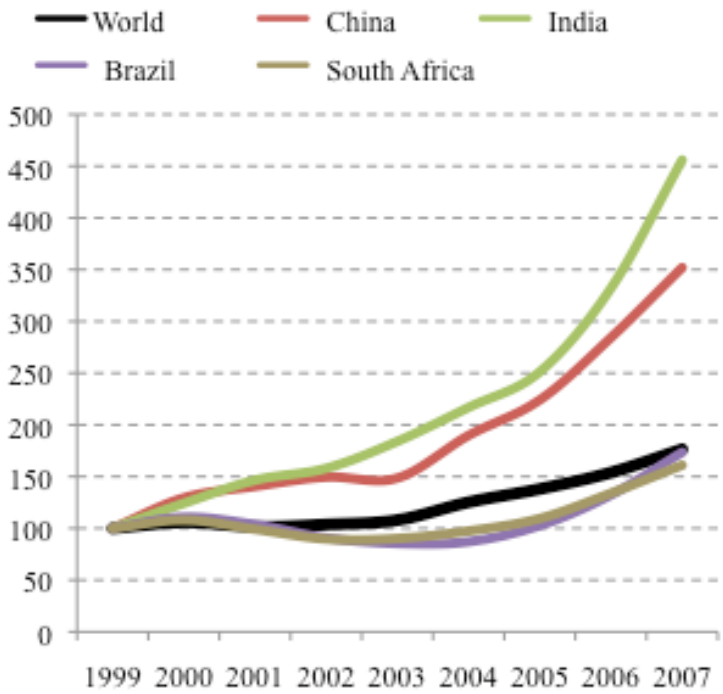


Evolution of trade in services from CIBS countries to the EU and USA

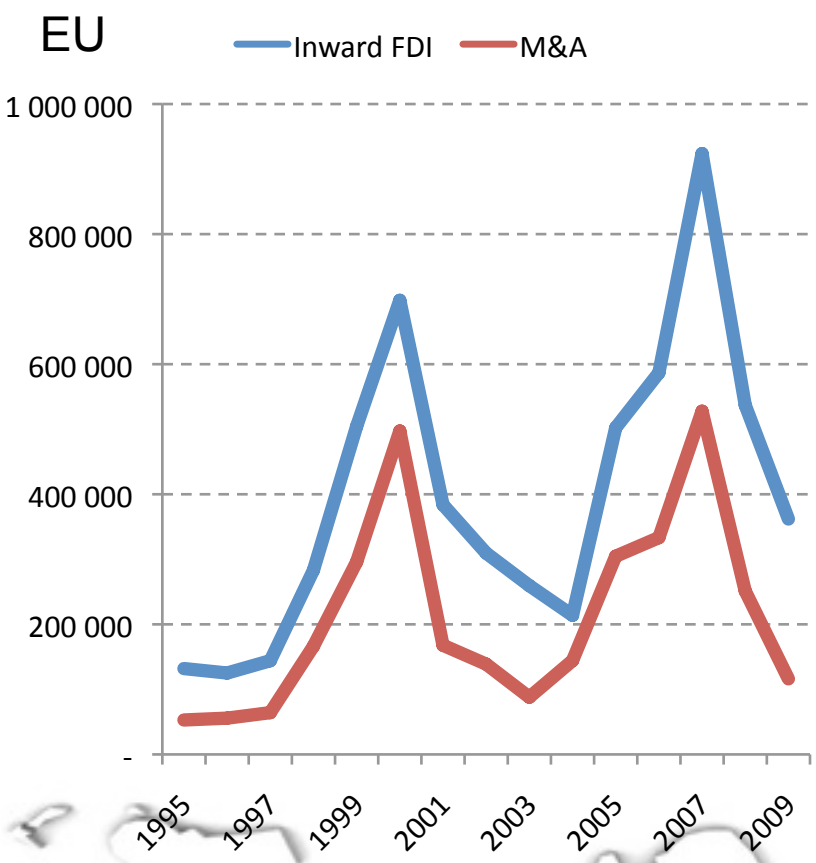
EU

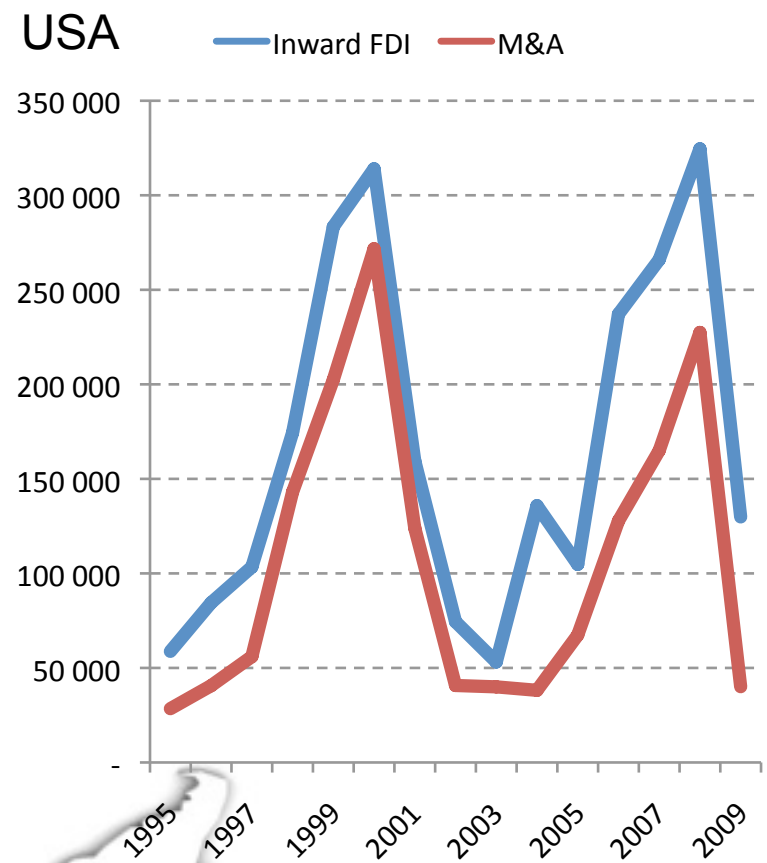


USA



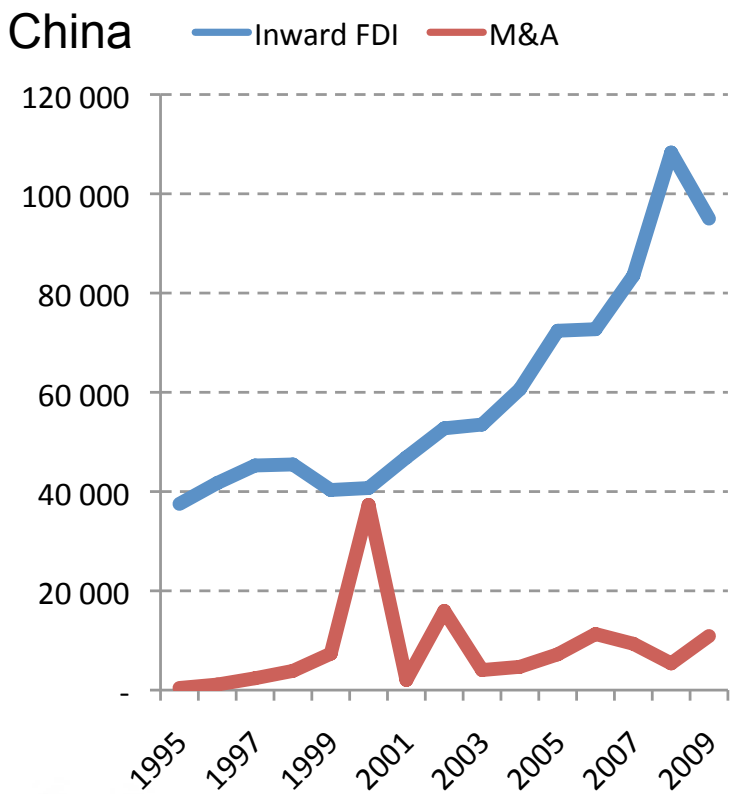
FDI Flows and value of global M&As in the EU and USA, 1995-2009

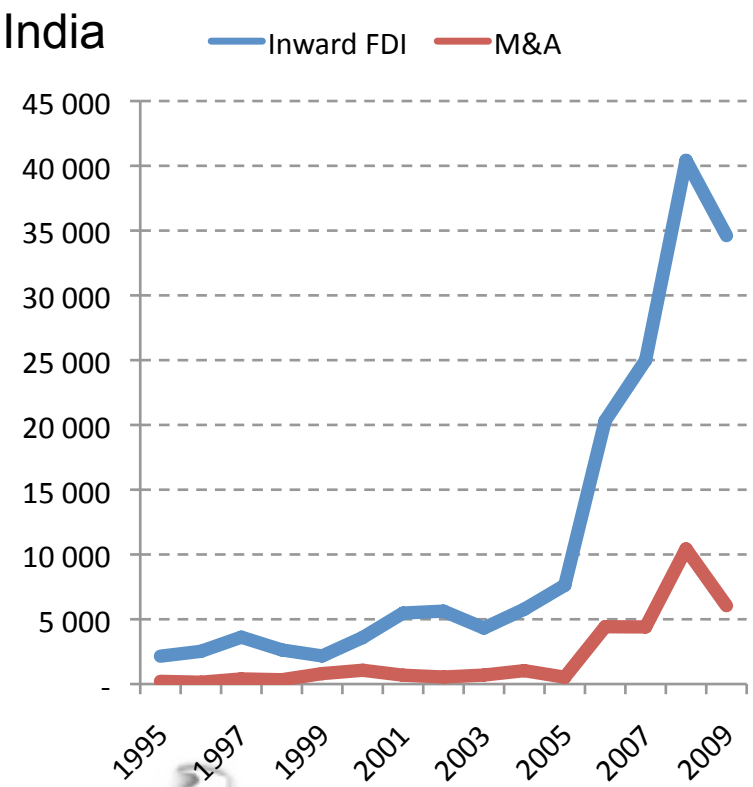




source: UNCTAD

FDI Flows and value of global M&As in China and India, 1995-2009

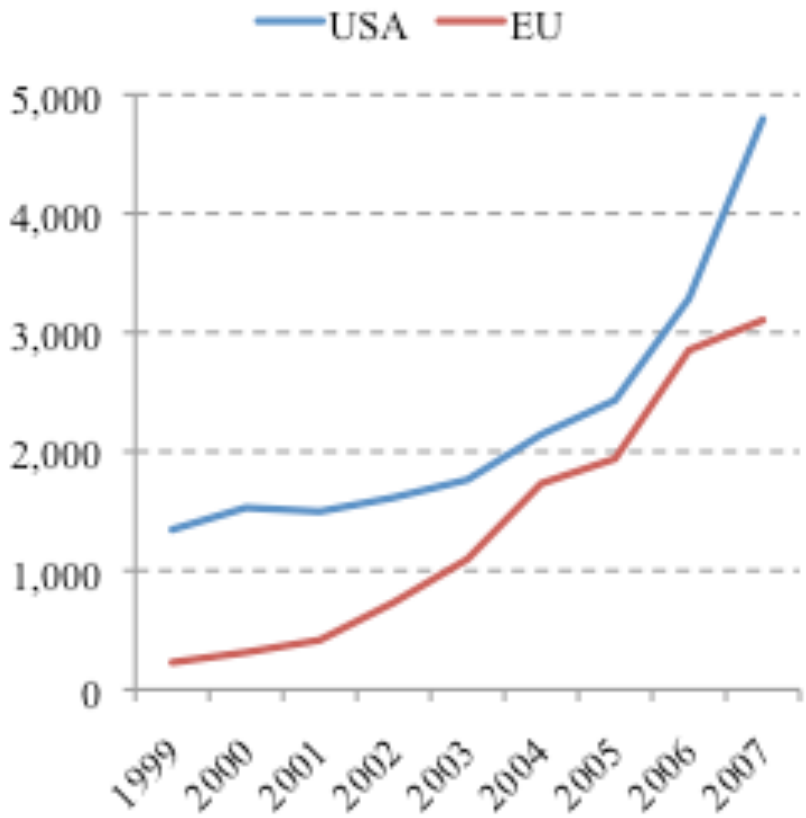




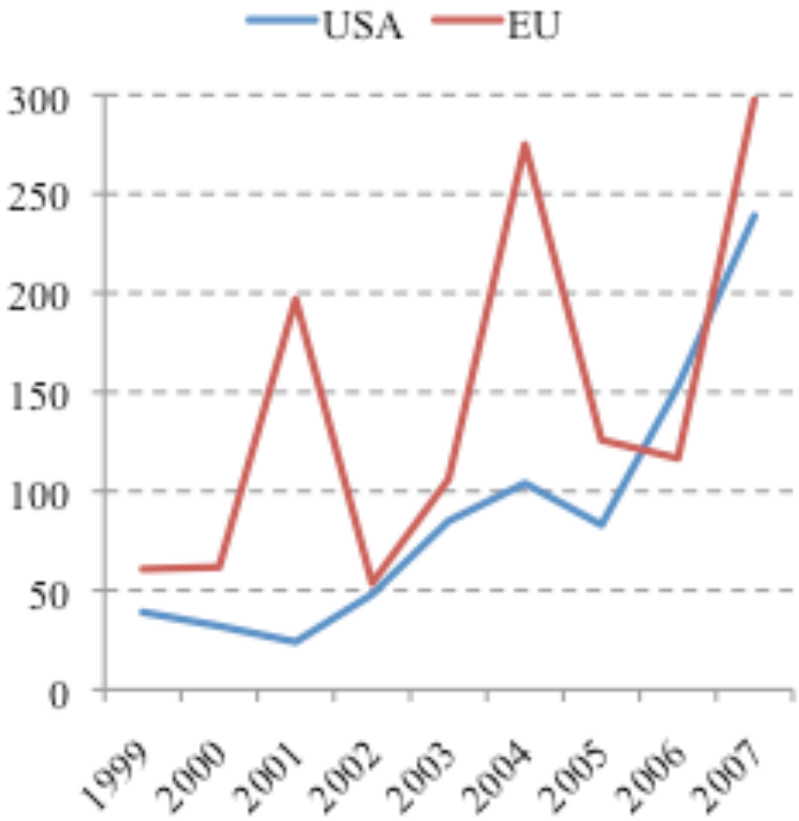
source: UNCTAD

Royalties and License fees from CIBS countries, 1999-2007

Payments by CIBS countries

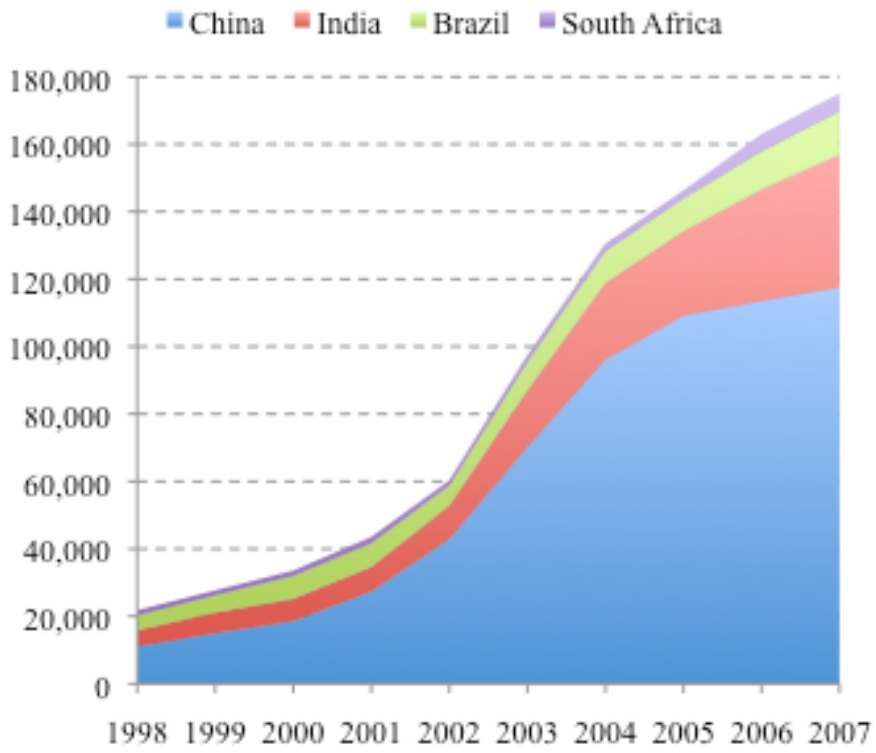


Receipts by CIBS countries

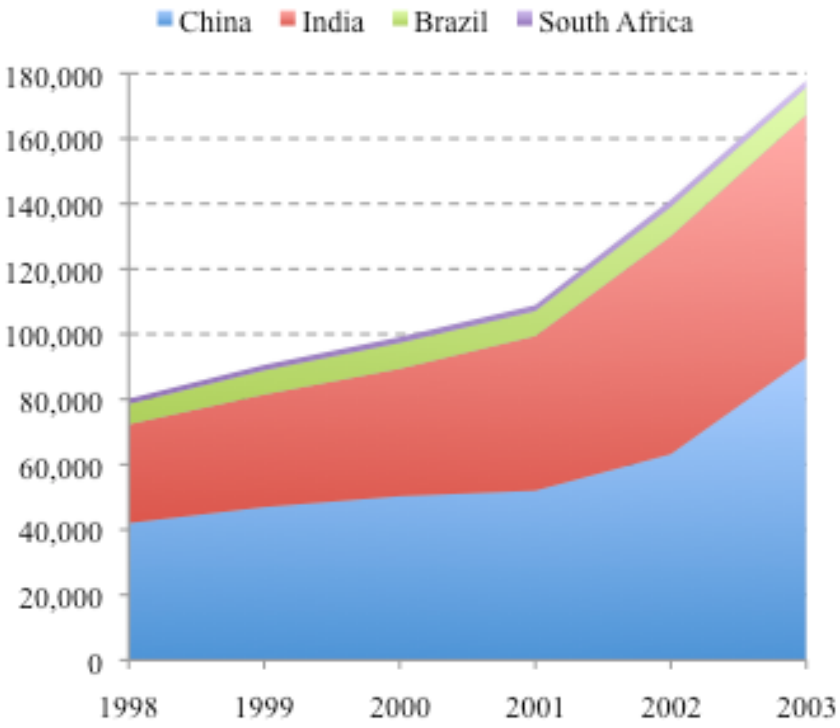


Foreign students enrolled in tertiary education

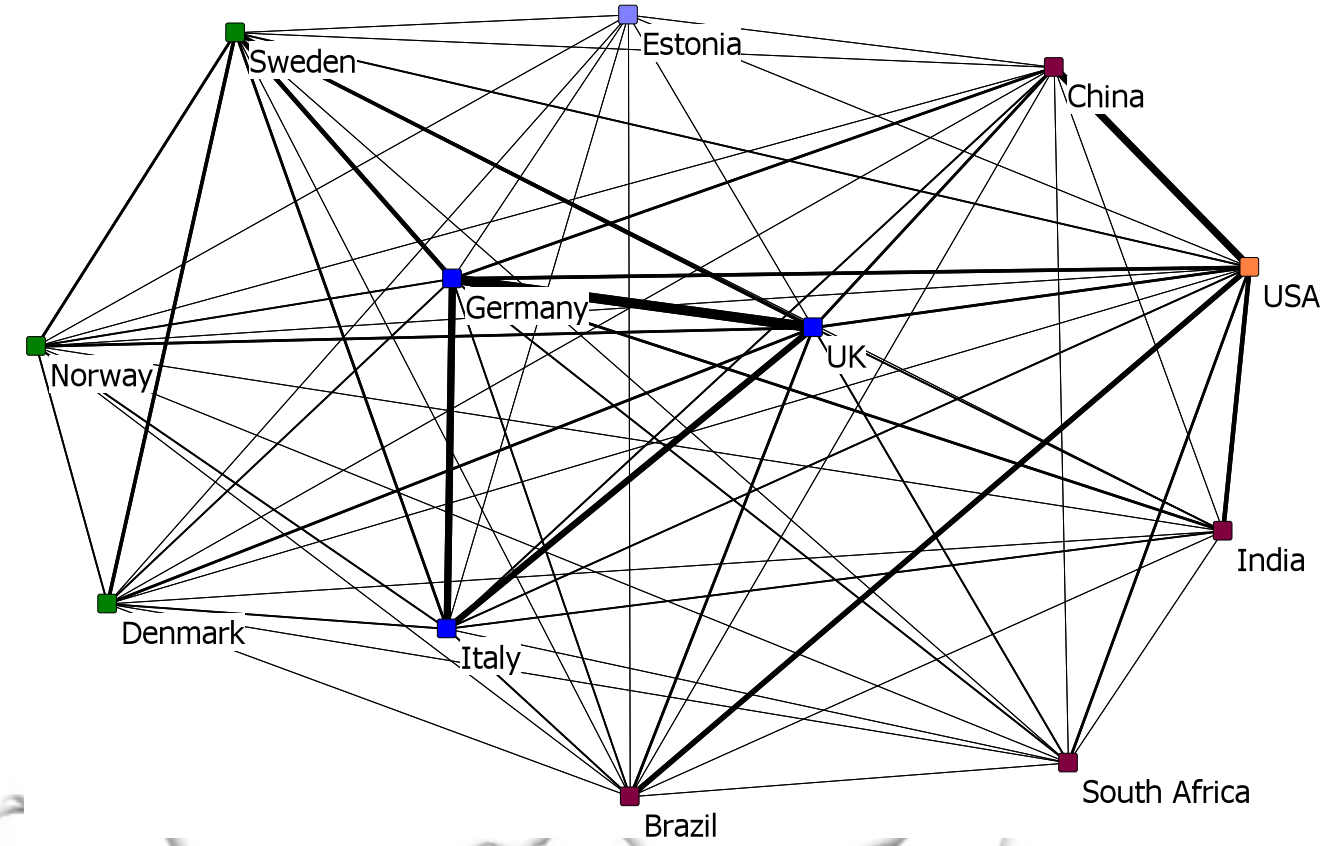
EU-27



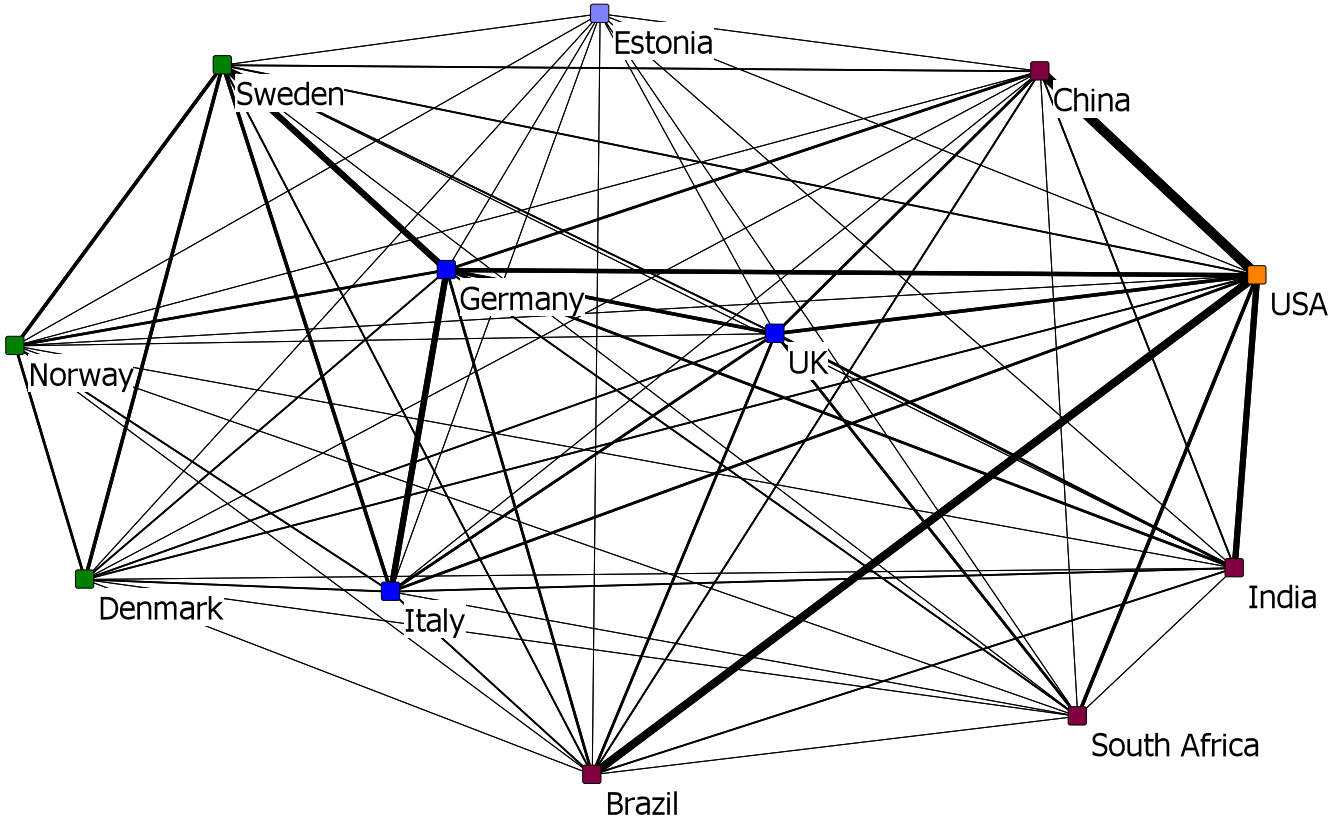
USA



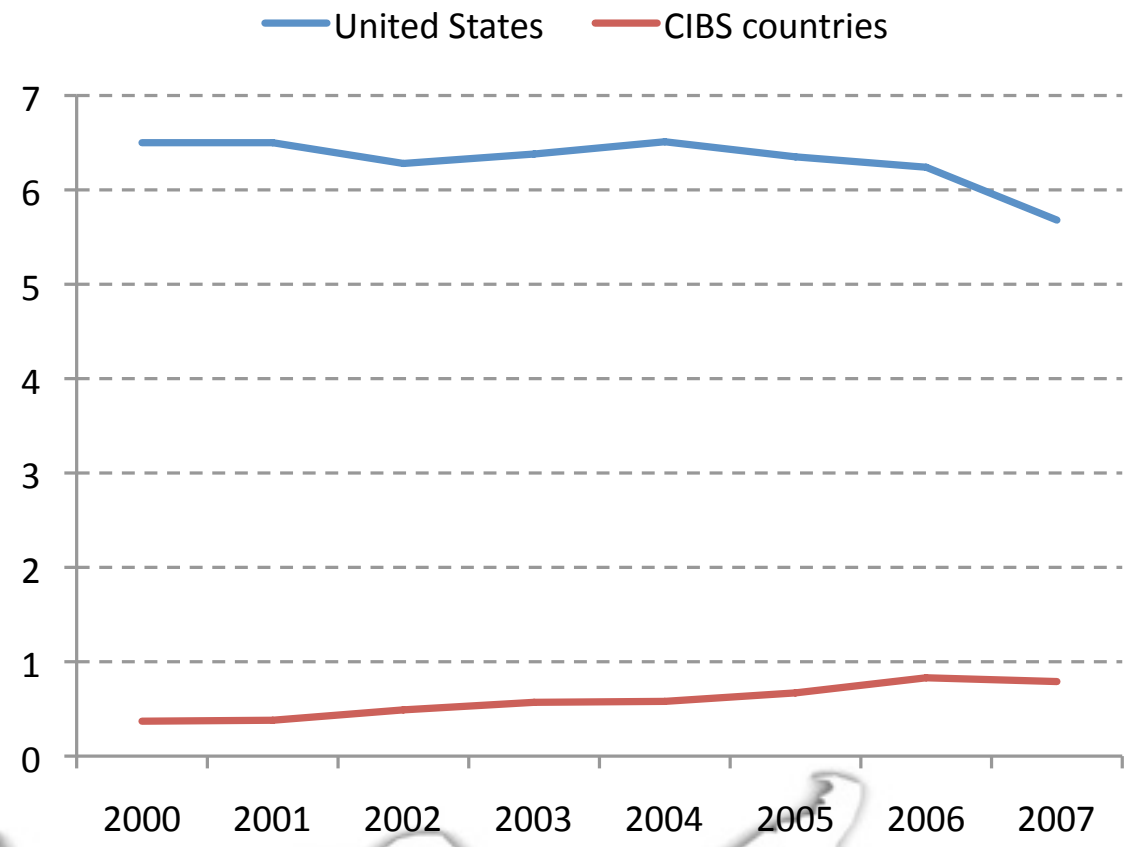
Research networks between Europe, USA and CIBS countries, 1997-99



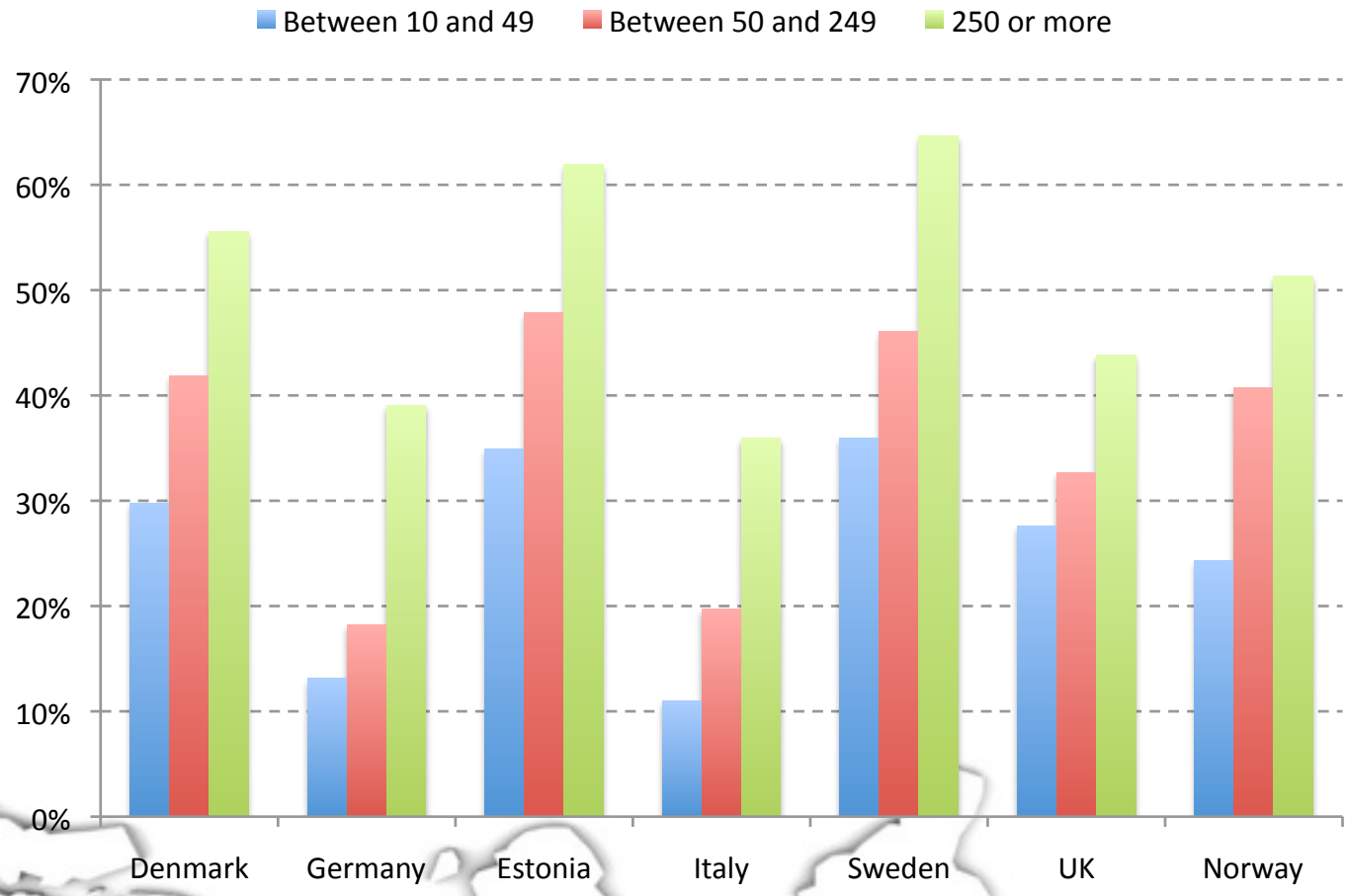
Research networks between Europe, USA and CIBS countries, 2007 – 09



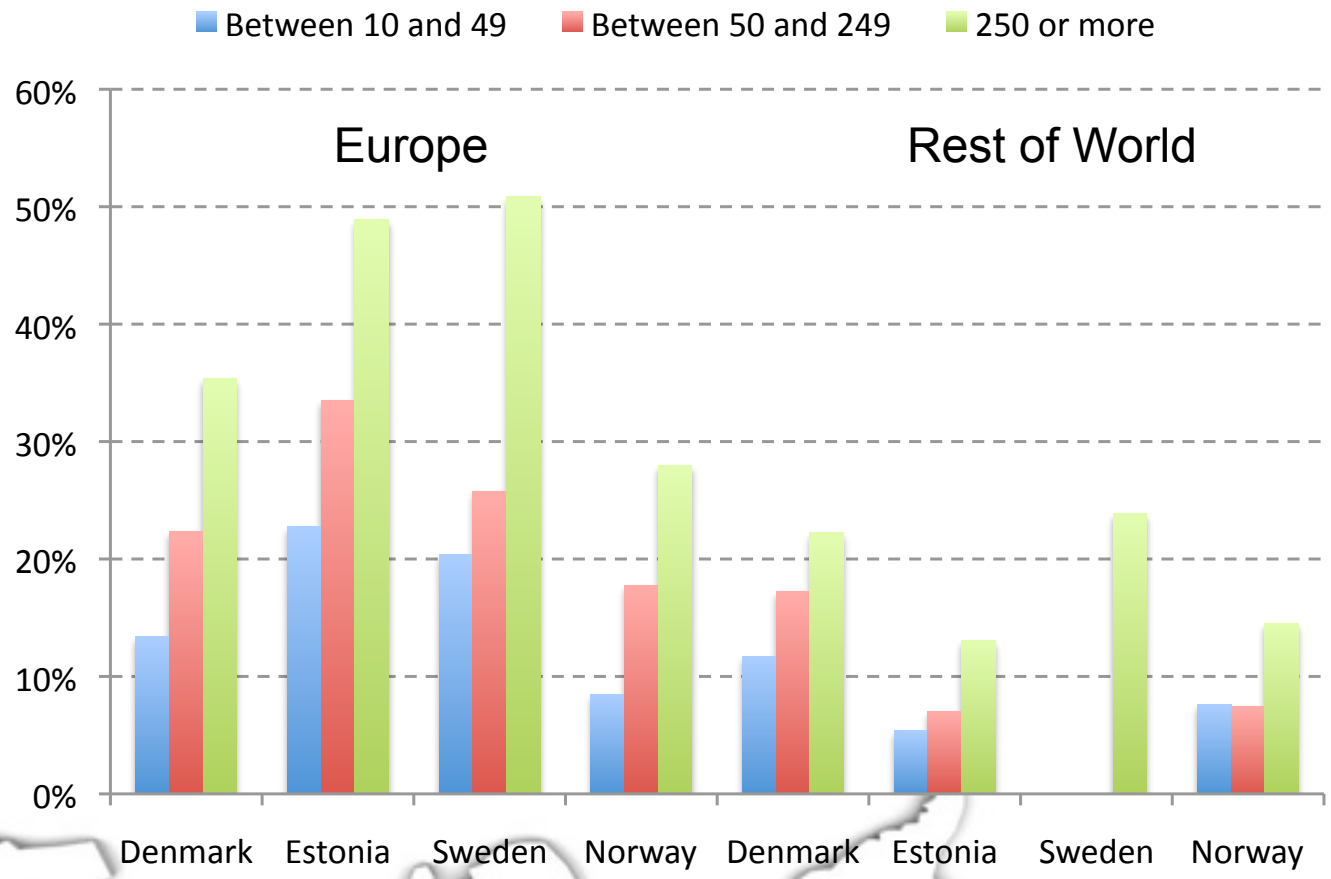
Percentage of EU-27 Patent applications with foreign co-inventor



Innovation cooperation



Global innovation cooperation



Future plans

- Plans to publish book, possibly with Edward Elgar

Thanks for your attention/ questions

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Norway

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Cape Town, South Africa

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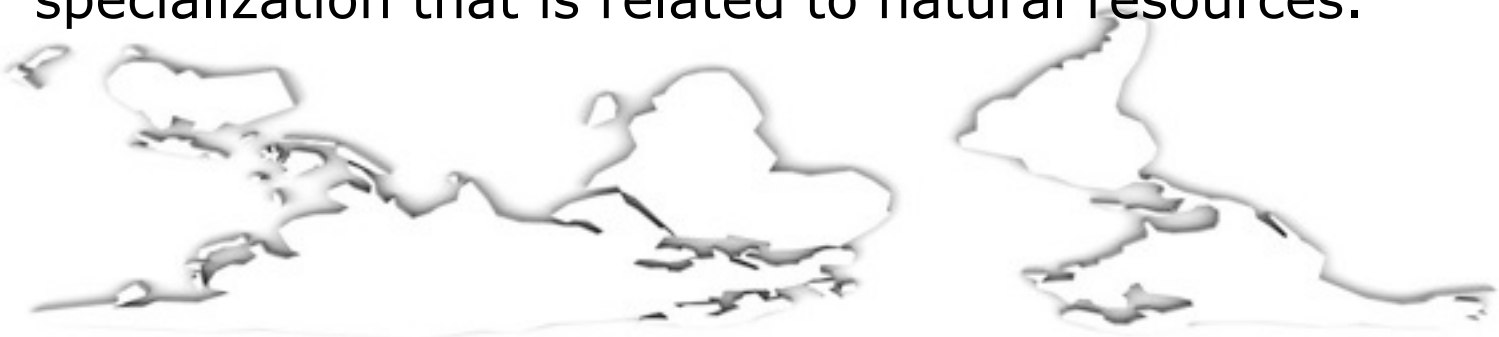
Norwegian Innovation System

- three different layers within the Norwegian innovation system:
  - small scale enterprises operating with little knowledge accumulation.
  - large scale enterprises that are knowledge intensive and rely on collaborative learning
  - small R&D intensive enterprises that rely on collaborative learning with other enterprises and research organizations and likely to operate within GINs
- This diversity intersects with a specific economic specialization that is related to natural resources.



- The relative weak performance of the Norwegian NIS, especially when measured relative to its GDP, has created a "puzzle"
  - There is a general over-emphasis on R&D-based indicators and on the impact that a high R&D-indicator performance has on economic growth
  - Petroleum revenues generate more than 20 percent of GDP
  - Norway does not have a large high-technology industry and therefore its R&D intensity is lower than ICT-producer countries
  - R&D spending in Norway is not very different from that in the largest OECD, when adjusted for the industrial structure.

Industrial Specialization

- **Mining** (mainly petroleum and gas extraction, NACE 11)
- **Fishing**, mainly fish farming (salmon)
- shipbuilding (in particular, building and repairing oil platforms and modules, NACE 35.114) and
- transport (both transport via pipelines, NACE 60.30 and general water transport NACE 61).
- Basic metals (NACE 27),
- Electricity, gas and water supply (NACE 40-41), mainly ***hydro***.
- Business services, mainly R&D and ***software***
- ***Photovoltaics*** (solar energy)

White Paper on *An Innovative and Sustainable Norway*

- The White Paper adopts the innovation systems framework.
- Emphasizes the horizontalization of innovation policies.
- Barcelona Target of 3% not taken literally any longer but only as an indicative target.
- A key objective is to respond to the challenges of the increasingly globalized economy.
- The White Paper strongly emphasizes the social dimension of innovation

Research priorities of RCN

- Budget is NOK 22.5 billion, while tax deductions through the SkatteFUNN scheme add another NOK 1.1 billion. **Total is about 3 billion Euros.**
  - This comprise **0.97 per cent of GDP**.
- Scientific priorities
  - Climate research and environmental technology
  - Research on renewable energy and carbon capture and storage
  - Research infrastructure
  - Regional research and value creation

Global and collaborative R&D activity

- Just under 9 percent of R&D is financed abroad, of which two-thirds comes from Foreign business enterprises and just under one-sixth from the European commission.
- About one-third of extramural R&D expenditures is performed abroad (but financed by domestic firms).
- More than half of research collaboration is with other Scandinavian countries, Germany, the UK and the USA and the percentage share has increased over the past decade.
- Co-patenting shows an even stronger relationship with these countries.

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