Science & Innovation in Japan
for Global Sustainable Development

Session 2: Capitalisation of Science to Socioeconomic Values
International Conference on Global Innovation Ecosystem

Kyoto, 8-9 September 2006

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OECD

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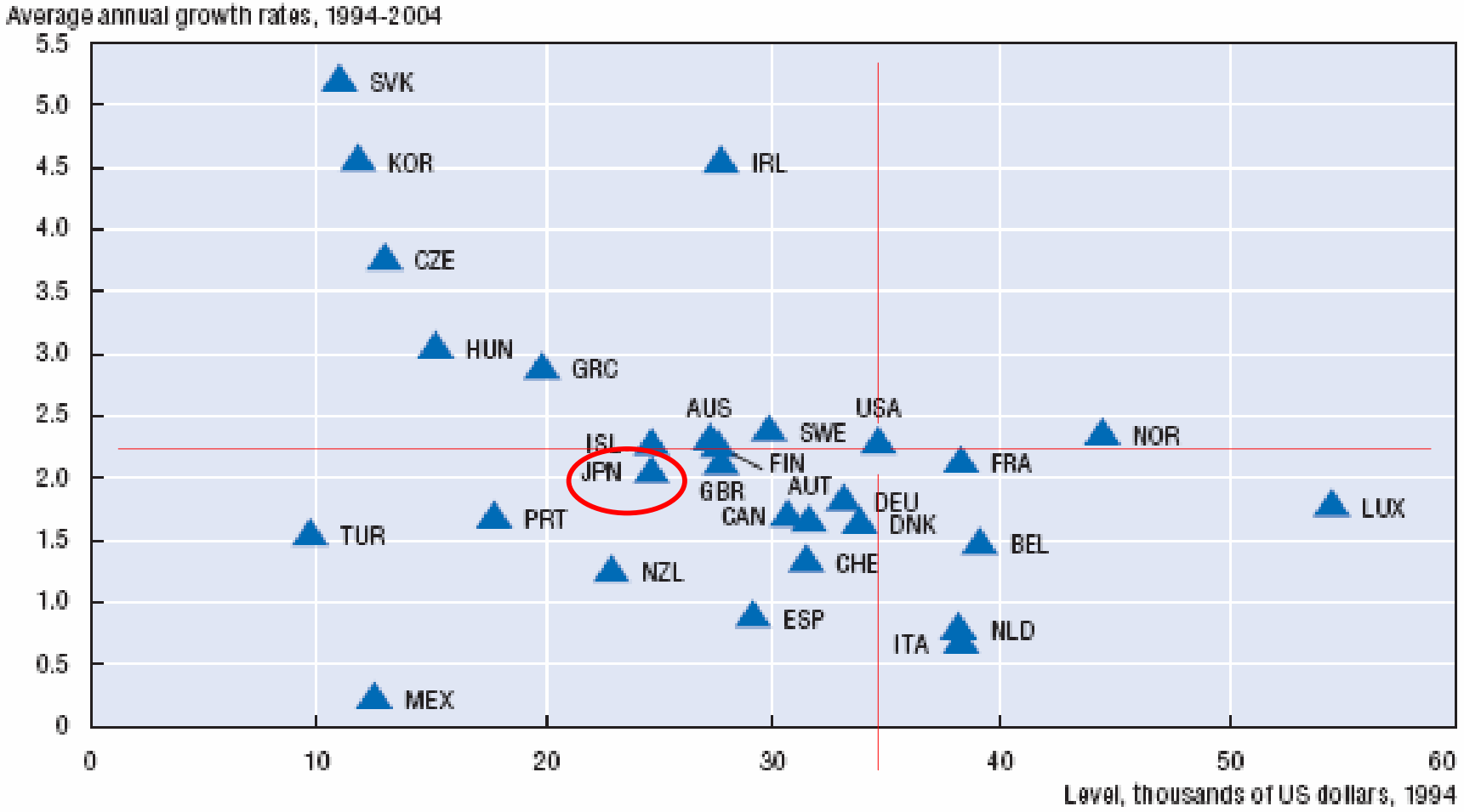
The importance of innovation

- Innovation is the key driver of economic growth - new and improved products, processes and services account for the bulk of economic growth since the Industrial Revolution.
- Innovation is of growing importance to economic activity in OECD countries – global competition is forcing all countries to upgrade their economic activity and move up the value chain.
- A growing number of countries has recognised the importance of innovation, e.g.:
  - Lisbon strategy in the EU
  - Policy strategies in the US, Japan and Korea to strengthen innovation
  - Growing policy focus outside the OECD, notably in China.
- Innovation has become more important to economic policy making – e.g. OECD *Going for Growth* report.

Figure 1.2. Labour productivity:[1] level and growth

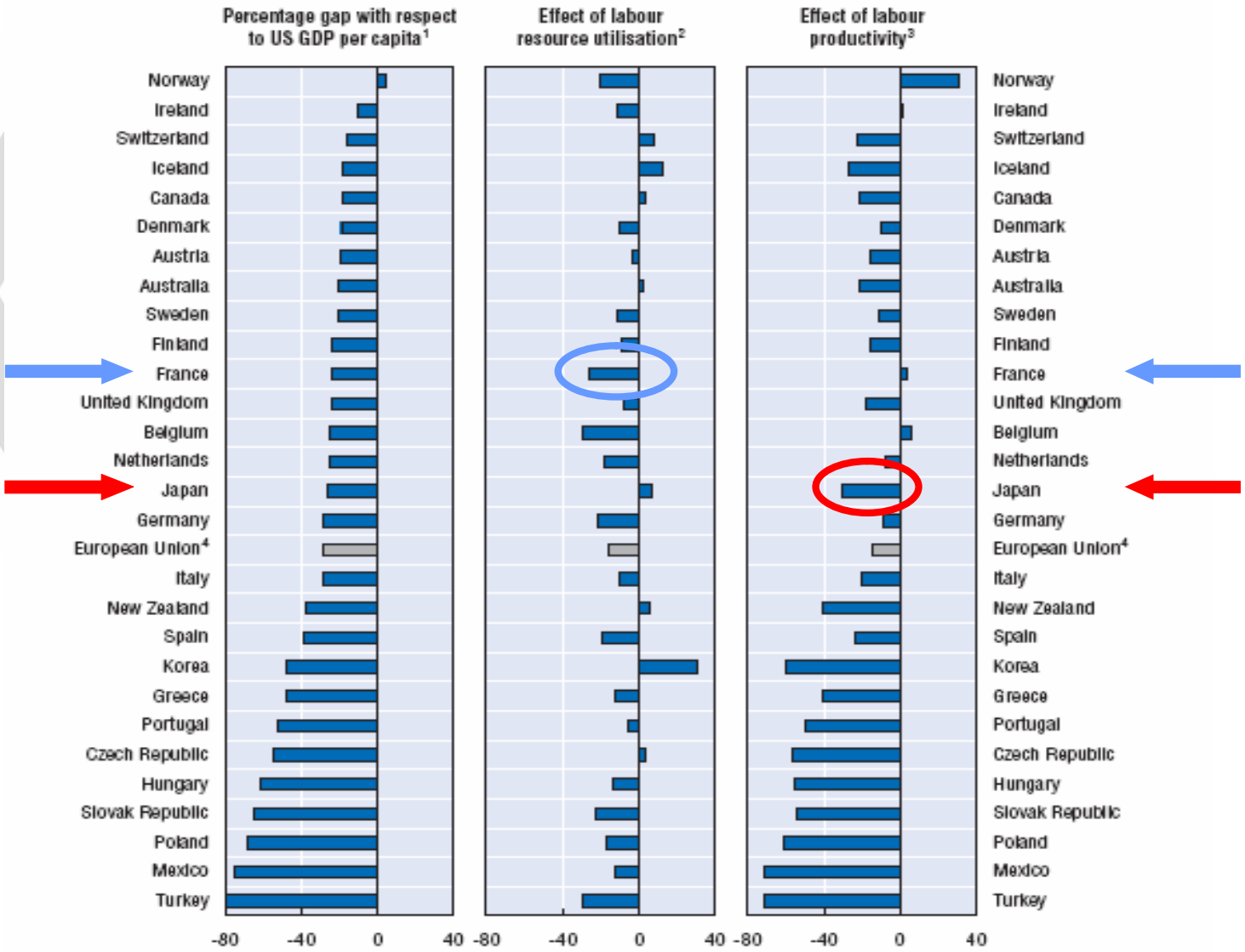


1. Measured as US dollar GDP in year 2000 PPPs per hour worked.

Source: OECD, National Accounts of OECD Countries, 2005; and OECD, Employment Outlook, 2005.

StatLink: http://dx.doi.org/10.1787/727533324237

Figure 1.1. The sources of real income differences, 2004



1. Based on year 2000 purchasing power parities (PPPs).
2. Labour resource utilisation is measured as total number of hours worked divided by population.
3. Labour productivity is measured as GDP per hour worked.
4. Excluding Luxembourg.

Source: OECD, *National Accounts of OECD Countries*, 2005; OECD, *Economic Outlook*, No. 78; and OECD, *Employment Outlook*, 2005.

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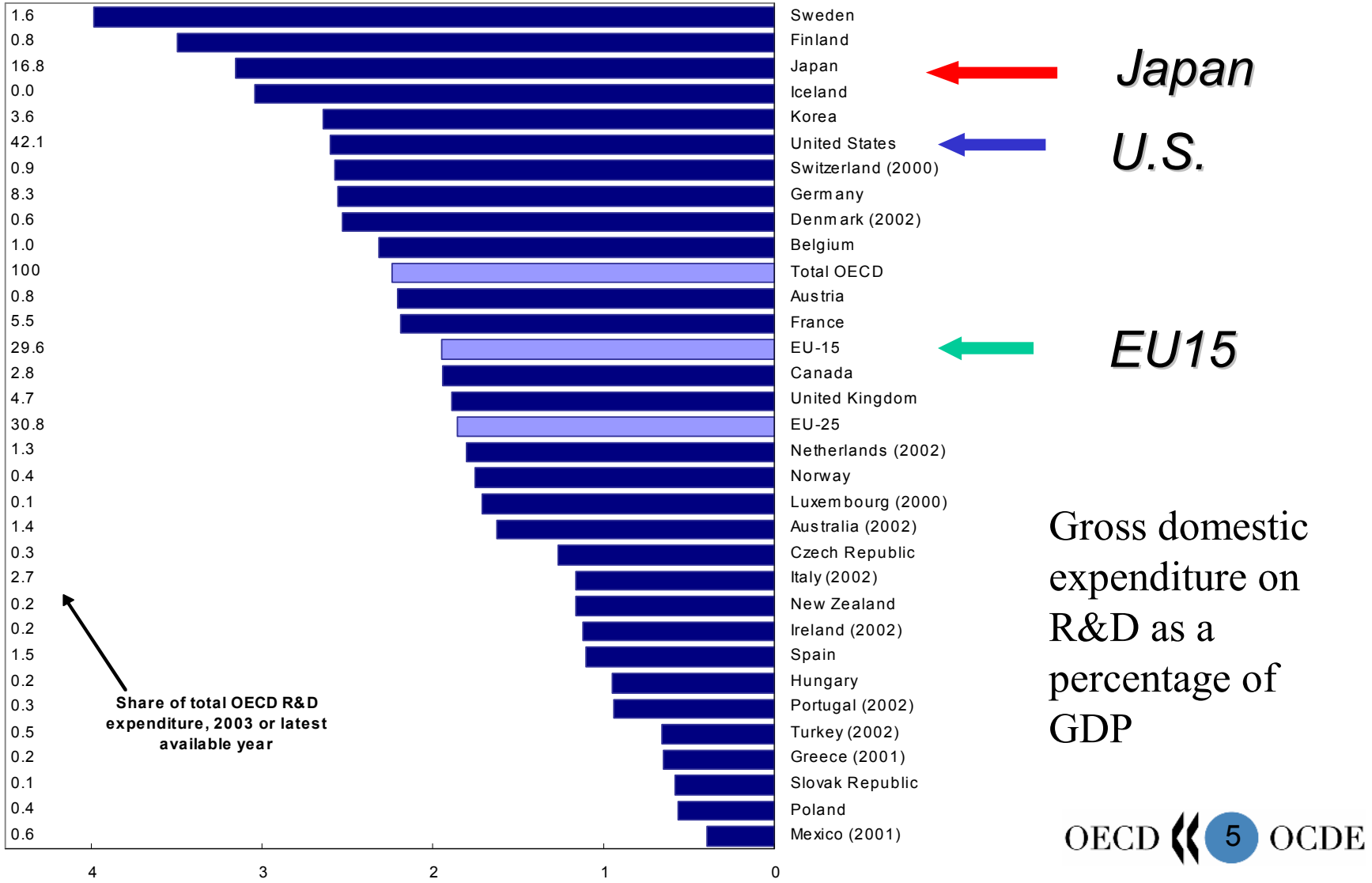
Going for Growth 2006

R&D intensity (GERD) in Japan is the 3rd highest in the OECD …

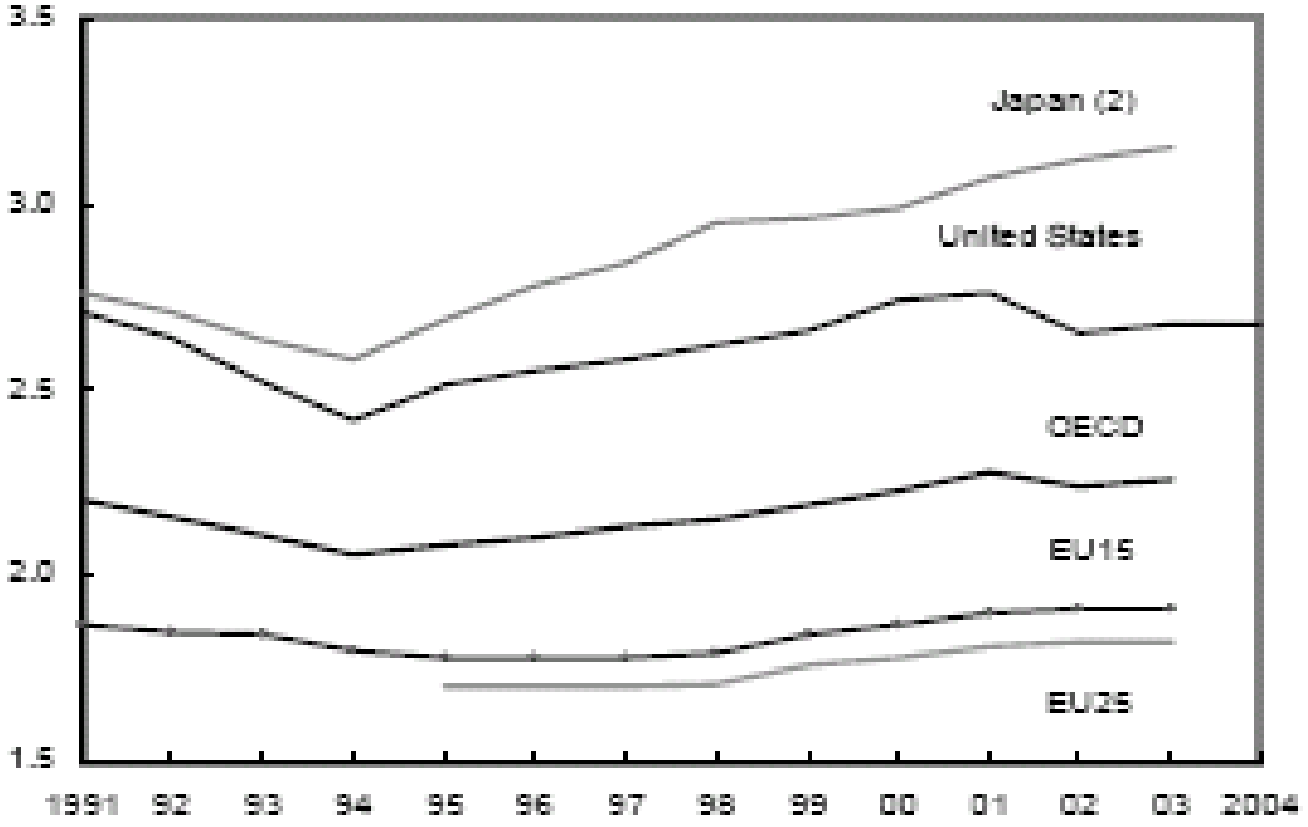


Gross domestic expenditure on R&D as a percentage of GDP

OECD STI Scoreboard 2005

Investment in R&D has been increasing, reflecting improved economic environment and growth of knowledge intensive industries…

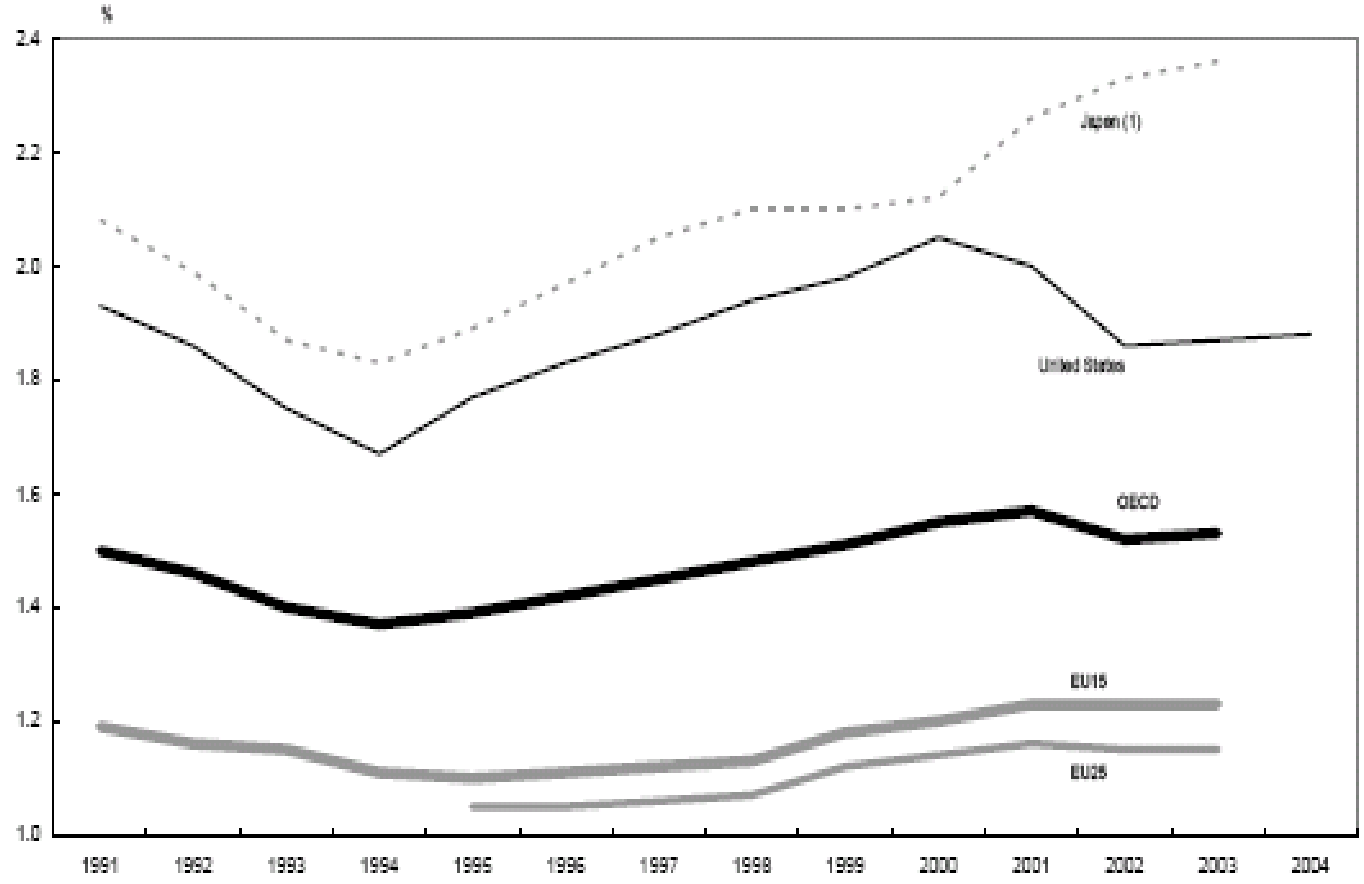
Trends in R&D Intensity(1) by area, 1991-2004 (as % of GDP)



1. Gross domestic expenditure on R&D as a percentage of GDP.
2. Data are adjusted up to 1995.

… so does business performed R&D (BERD).

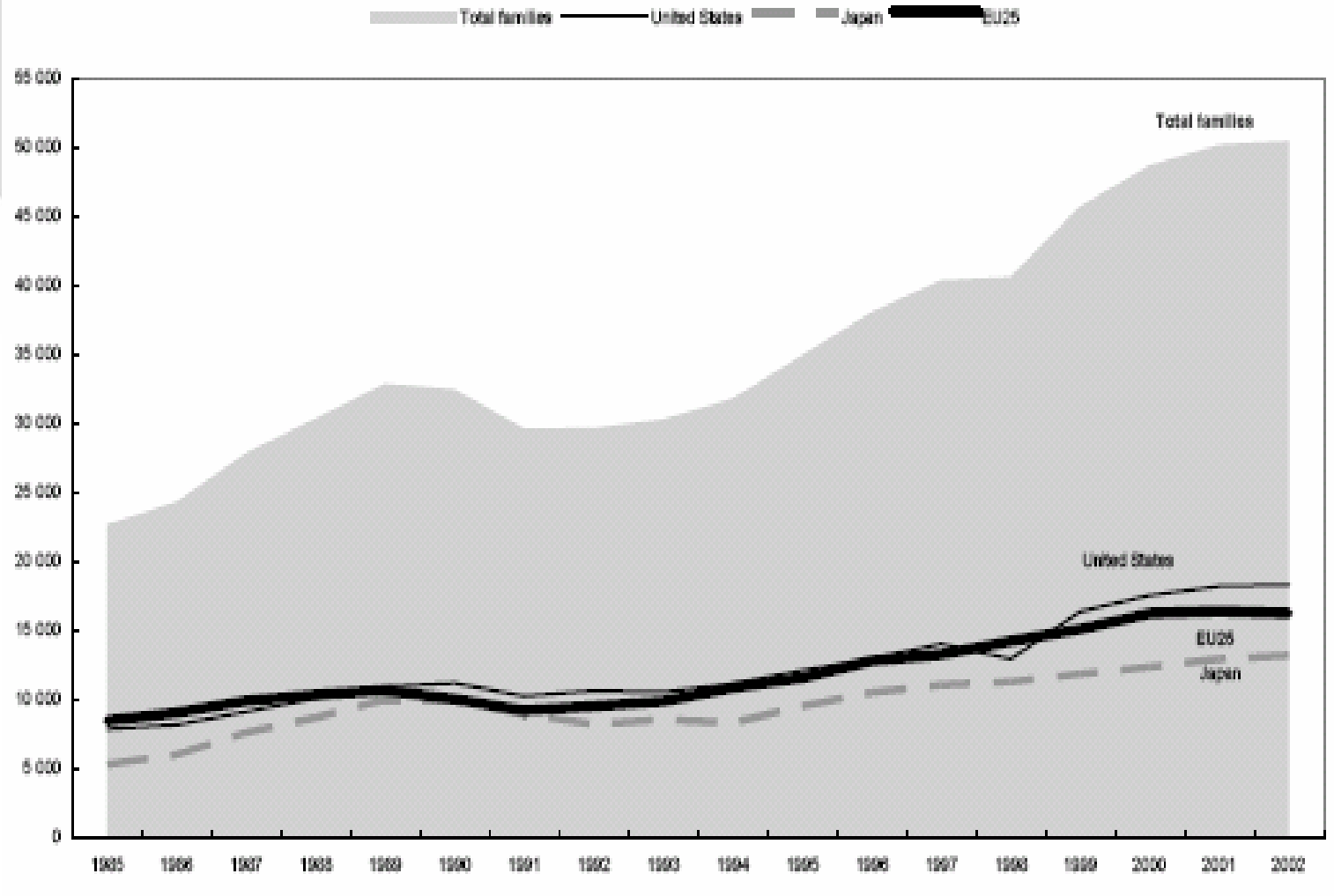
Trends in BERD Intensity by area, 1991-2004 (as % of GDP)



Source: OECD Main Science and Technology Indicators Database, May 2002.

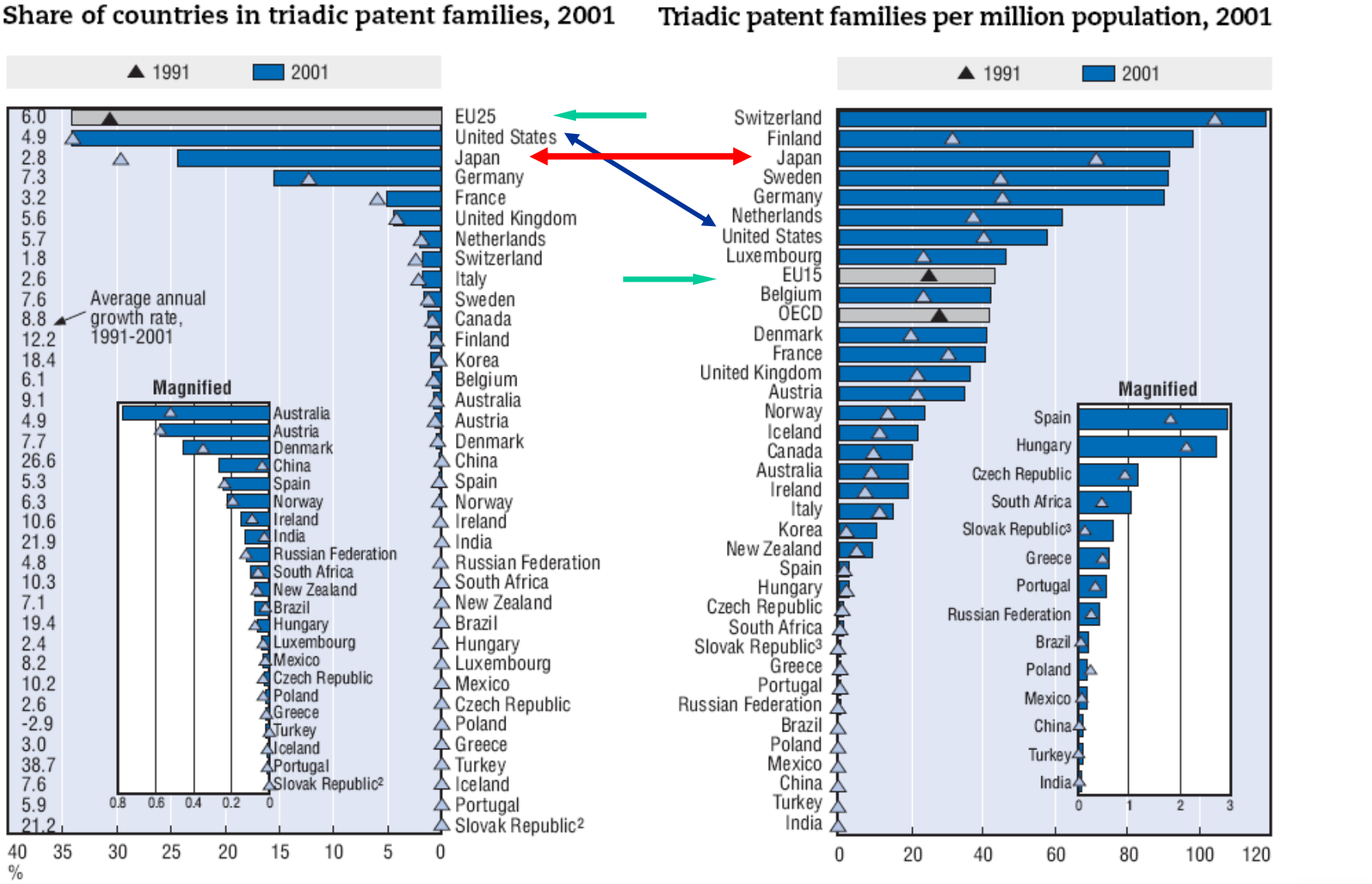
Changes in business R&D expenditure are mirrored by changes in patenting.

Trends in Triadic Patent Families



OCDE

Patent Ranking

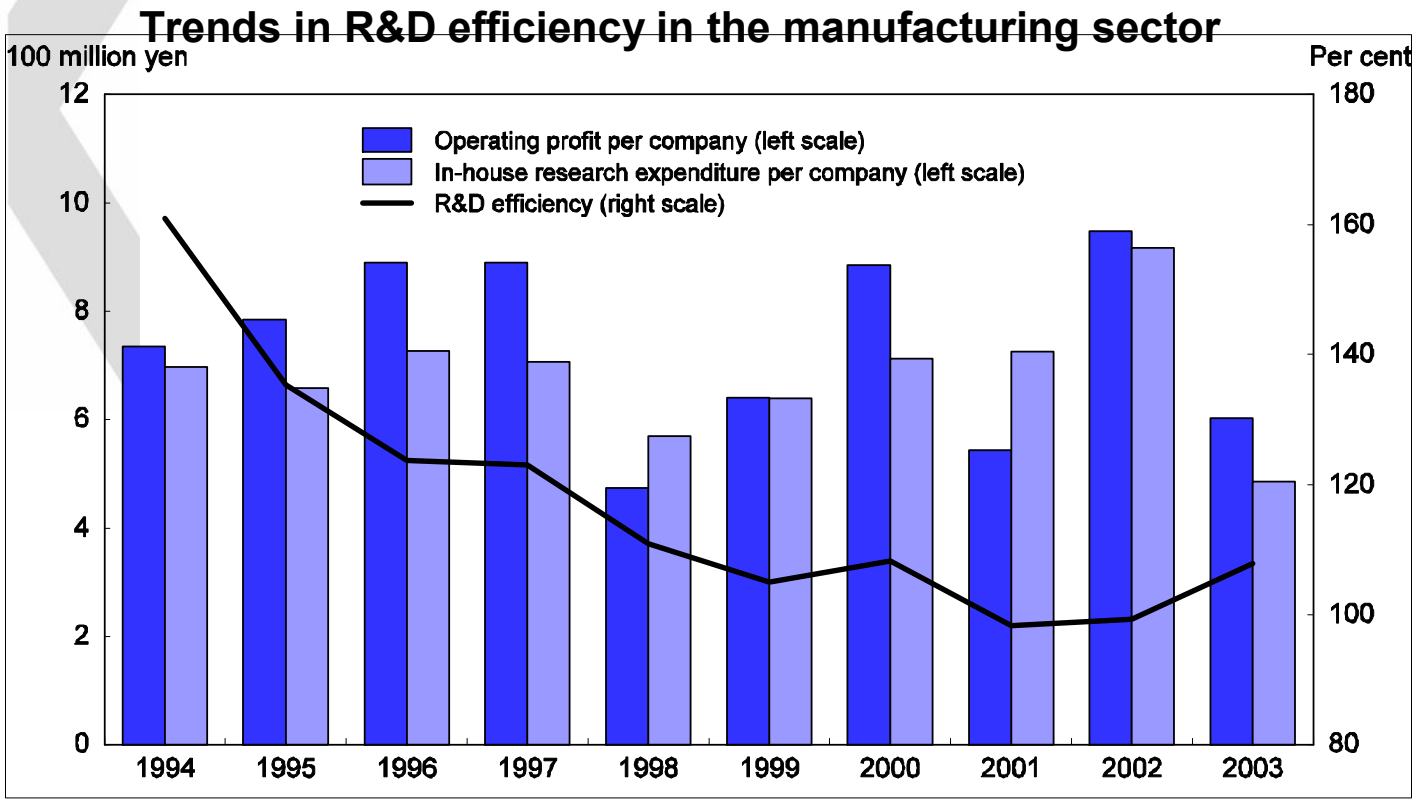


Proportion of firms reporting successful innovations in Japan is well below the EU average.

Note: The survey period was 1999-2001 for Japan and 1998-2000 for the European countries. The EU average is the average of the 13 EU countries shown in the figure. There is a need for caution in evaluating such surveys because of the low response rate in Japan.

Source: National Institute of Science and Technology Policy, *National Innovation Survey 2003, and Eurostat, Innovation in Europe.*

MFP growth declined through 1990s in Japan despite higher R&D spending.



Note: R&D efficiency in each fiscal year is calculated as (cumulative operating profit per company over the preceding five years)/(cumulative research expenditure per company used in-house over the period five to nine years prior to the given fiscal year).

Source: Cabinet Office, *Annual Report on the Japanese Economy and Public Finance 2005*.

Key Issue for Japan:

- ***How to extract economic values from high level of R&D investment in Japan***

- ***How to modify closed and self-contained innovation system in Japan***

Countries that are successful in innovation share common characteristics

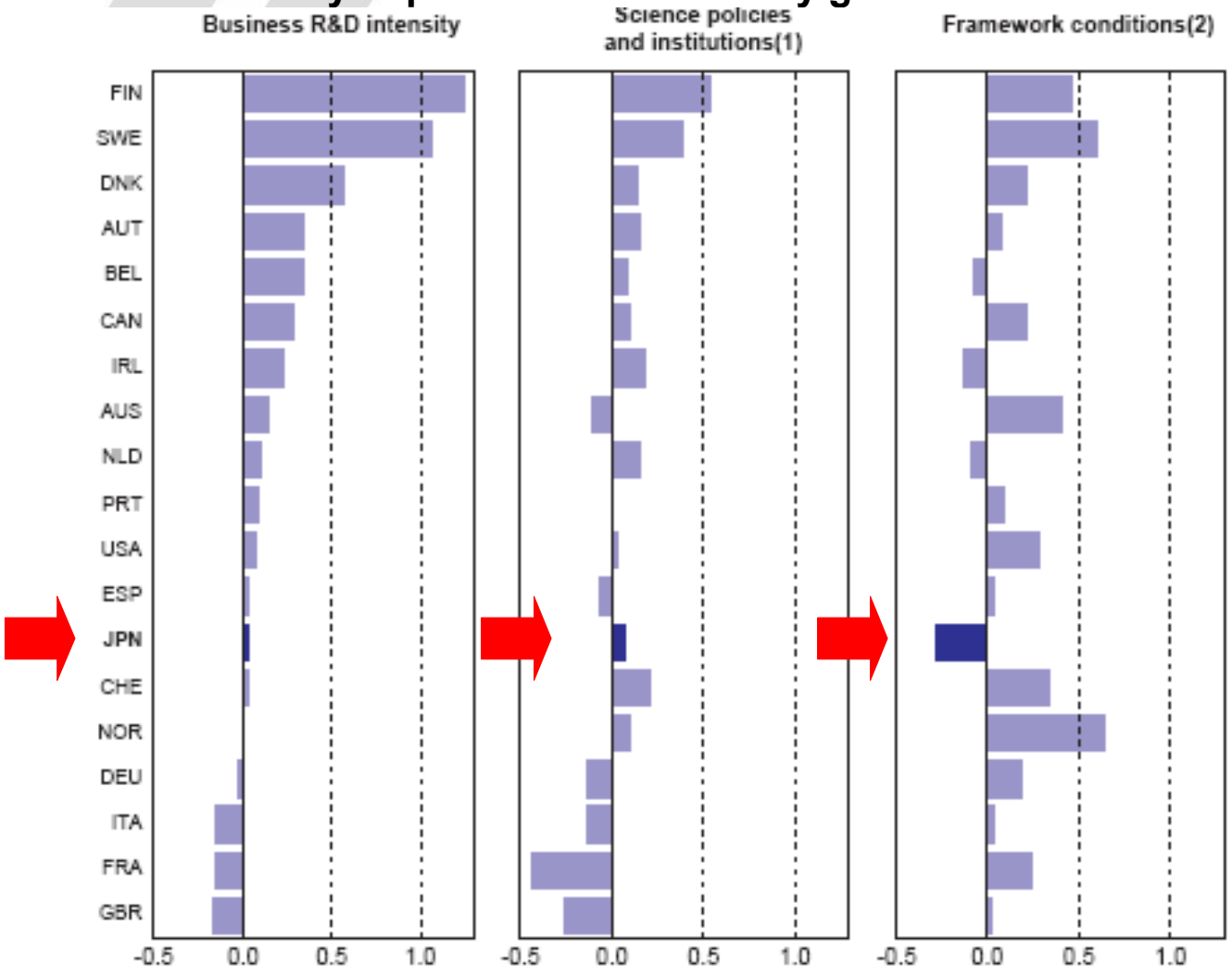
- Good fundamentals, including well-functioning labour and product markets and sufficient international openness
- Above average improvement in innovation due to:
  - Strong investment in knowledge (education, ICT and R&D)
  - Success in turning new technology, notably ICT, in stronger productivity growth and process innovation, e.g. in services.
  - High share of business in financing R&D
  - A diversified base of innovators, with a greater role for small technology-based firms, thanks *inter alia* to a supportive financial system
  - Solid regional pillars of national development, i.e. vibrant innovative clusters
  - High level of networking among innovators, especially strong linkages between science and industry

Innovate the system: It is more than S & T policies

- Innovation requires strong fundamentals.
- But strong fundamentals are not necessarily sufficient – a range of market and system failures may limit innovation
- Innovation policy must address these problems, e.g.:
  - Innovation may be held back by barriers to interaction between partners in the innovation process, e.g. between clients and firms, between universities and firms, at the international level, etc.
- Some key trends in innovation policy in recent years:
  - Reform to universities and public research organisations – greater autonomy, flexibility and focus on performance.
  - Growing policy efforts to foster greater investment in business R&D and innovation.
  - Increased emphasis on networking and co-operation.
  - Growing focus on international S&T co-operation.
  - Greater attention for policy **evaluation.**
  - More attention to the Governance of the R&D system

Weak framework condition explains low performance in Japan.

Policy Impact on R&D intensity growth in 1990s



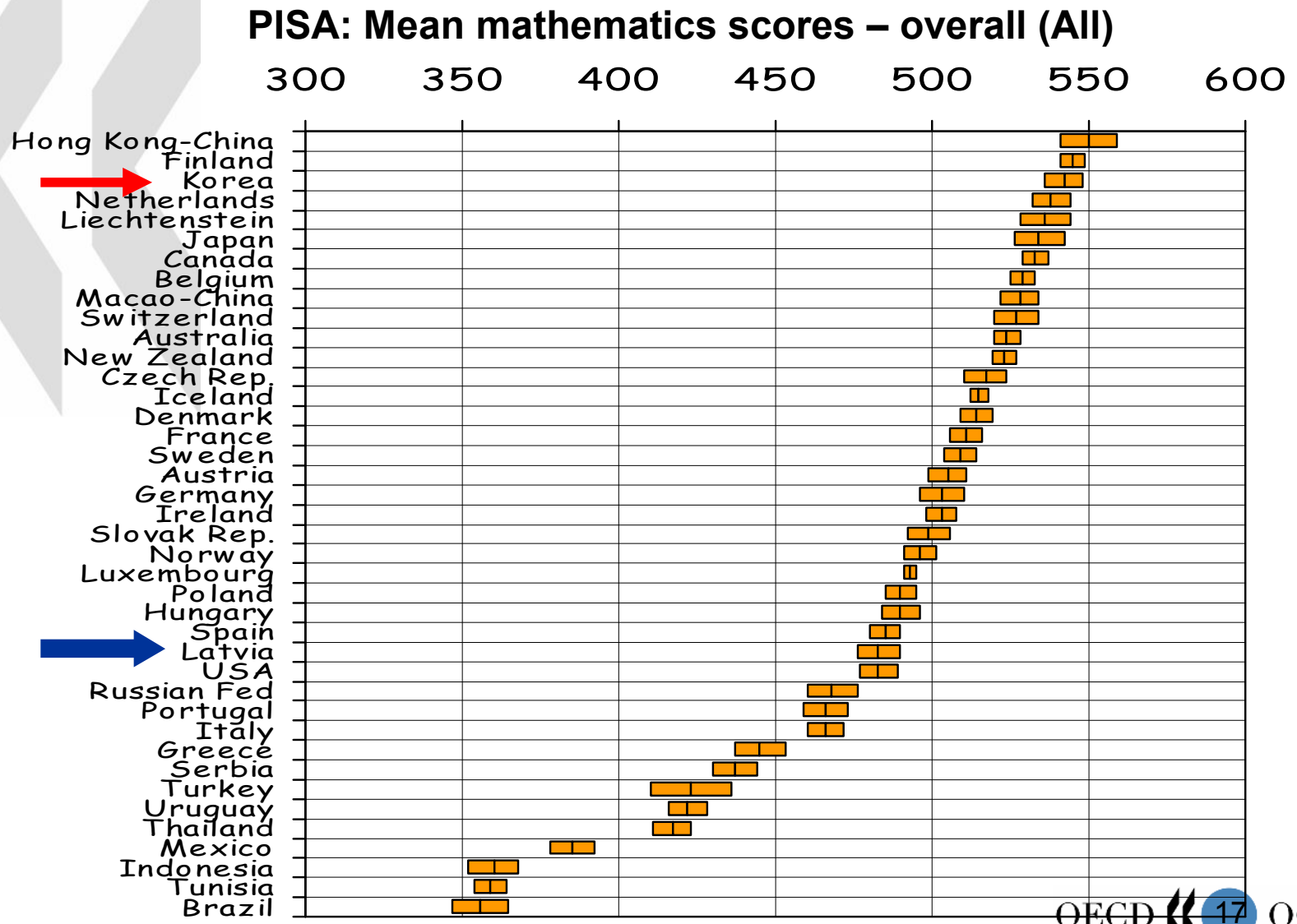
1. Science policies include R&D tax incentives, subsidies for private R&D, business funding of non-business R&D, non-business R&D intensity, intellectual property rights and absorptive capacity (capacity to understand and make use of foreign knowledge).
2. Framework conditions include financial factors, real interest rates, real exchange rates, foreign exposure (foreign R&D stock and openness), import penetration, product market regulation, employment protection legislation, human capital and the domestic economy-wide average wage.

Source: OECD (2005), Innovation in the Business Sector.

Framework policies that influence innovation performance-1 (Policy Indicators)

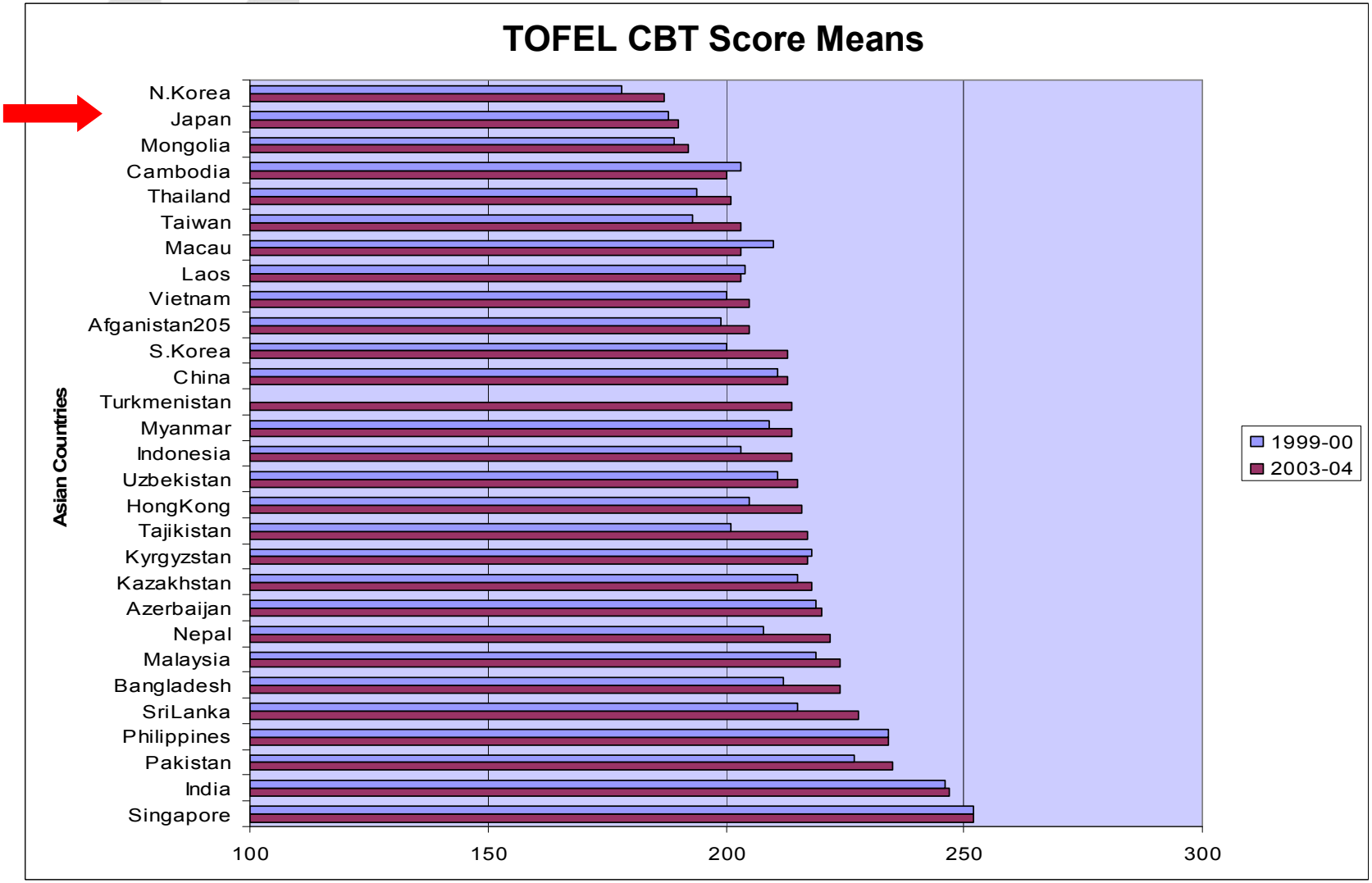
- **Education**
  - Basic educational skills, especially quantitative, measured by performance (PISA)
  - Accessible, high-performing tertiary education system (e.g., share of population w/ tertiary education)
  - Training of scientists and engineers – concerns in many countries about matching supply to demand (ageing workforce, low enrolment)
- **Financial markets**
  - Access to financing important for innovation, especially to risk/venture capital
  - Influenced by: taxation of capital income and capital gains; portfolio restrictions in institutional investors; barriers to cross-border M&A; efficiency of bankruptcy procedures
- **Labour markets**
  - Employment protection laws influence innovation via ability of firms to hire/fire and incentives to invest in training
  - Analysis found little effect of EPL on R&D spending, but some effect on patenting (related to mobility?)

Japanese students are good at math…



OECD (2004), *Learning for tomorrow's world: First results from PISA 2003*, Table 2.5c, p.356.

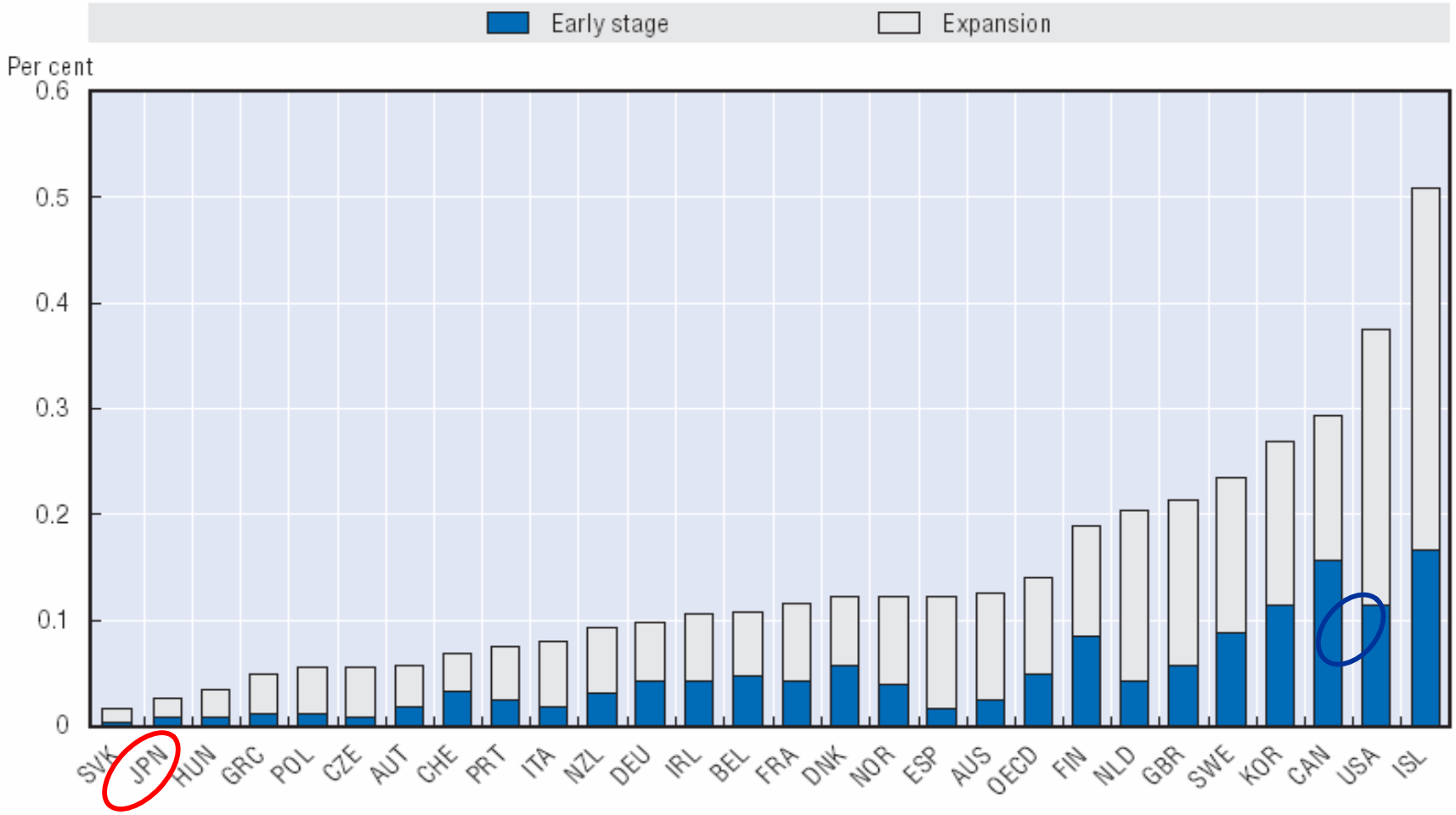
…but weak in English.



Ex. France=236, Italy=217, Germany=253 (2003-4)

Venture capital investment and entrepreneurship is weak in Japan

Figure 3.7. **Venture capital investment flows as a percentage of GDP, 2000-03**[1]



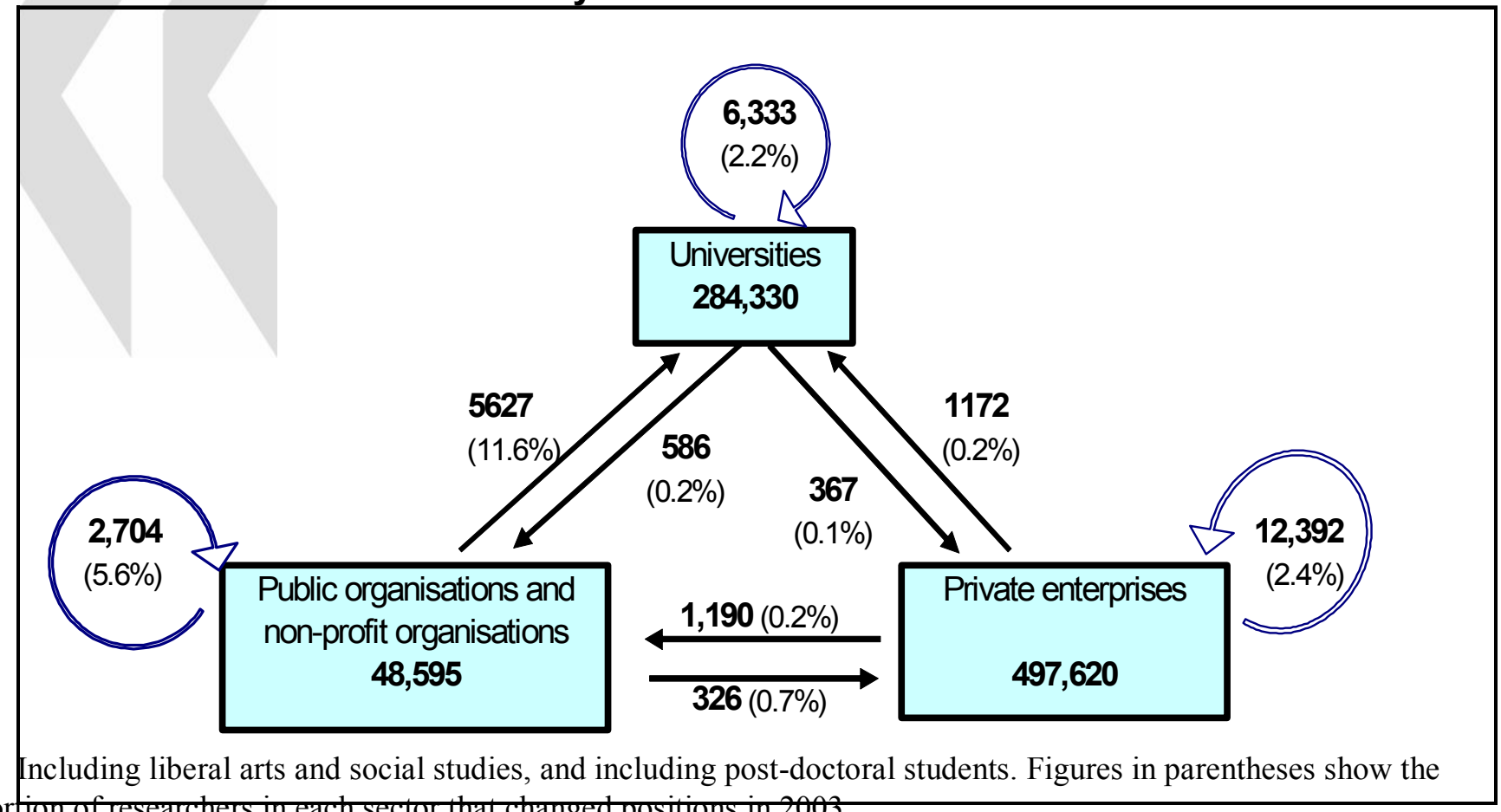
1. 2000-02 for Iceland; 1998-2001 for Australia, Japan, Korea and New Zealand.

Source: OECD, Venture capital database.

StatLink: *http://dx.doi.org/10.1787/462688616478*

Movement of researchers among institutes is extremely low in Japan

Mobility of researchers in FY 2003



Note: Including liberal arts and social studies, and including post-doctoral students. Figures in parentheses show the proportion of researchers in each sector that changed positions in 2003.

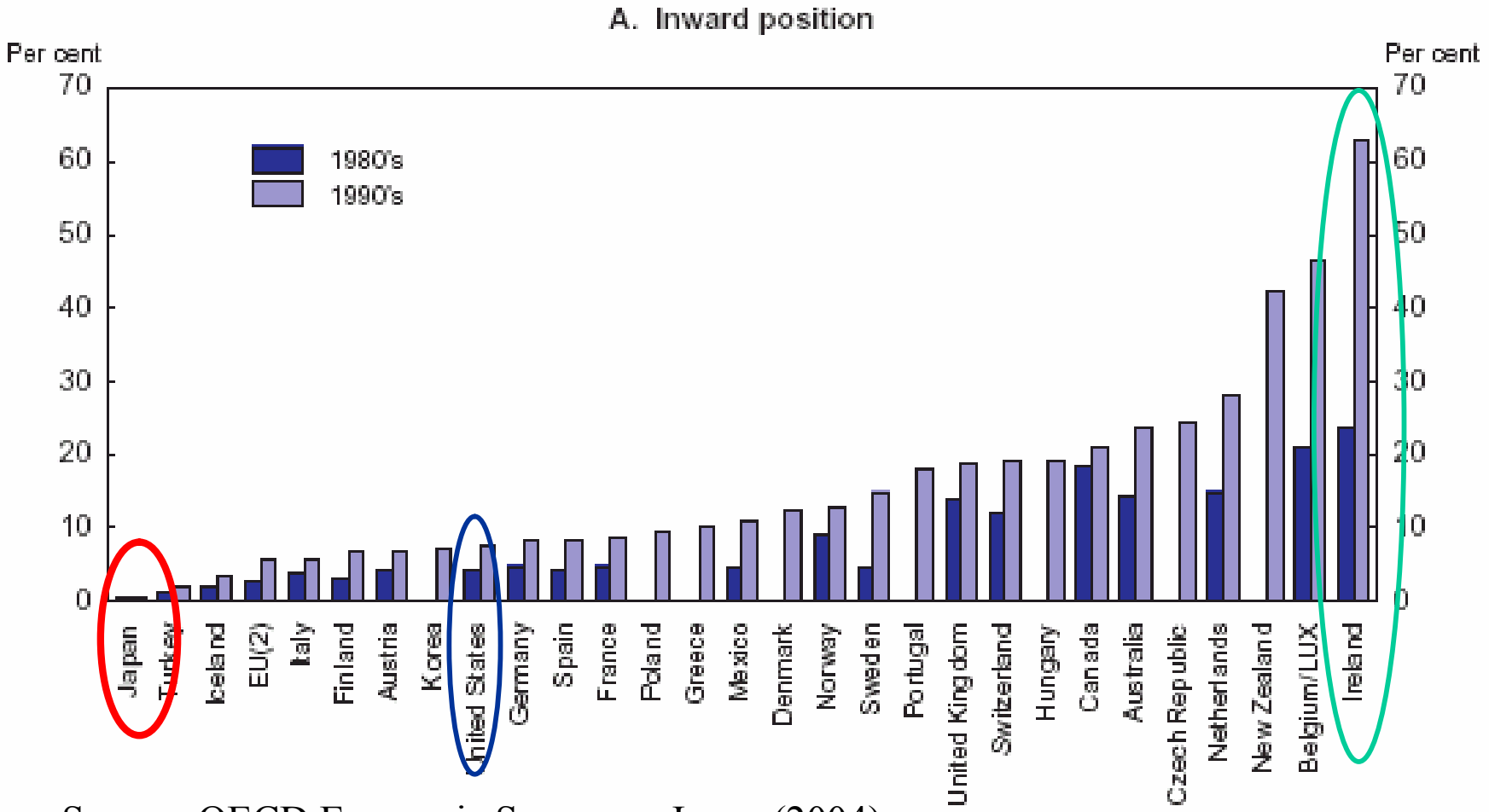
Source: National Institute for Scientific and Technological Policy (NISTEP) and Mitsubishi Research Institute (2005).

Framework policies that influence innovation performance-2 (Policy Indicators)

- **Openness and restrictions on FDI**
  - Foreign R&D makes large contribution to productivity growth
  - Multiple channels: FDI, international mobility of human resources, participation of foreign firms/researchers in R&D programmes, etc.
  - Openness influenced by FDI regulations and active support for mobility and engagement in international networks of innovation where appropriate.
- **Product market competition and IPR**
  - Strong PMR encourages investments in innovation to stay ahead of competitors, but can weaken firm's ability to appropriate returns
  - Strong IPR can enable firms to appropriate returns from investment in innovation, but can foster monopoly positions
  - Issue is striking appropriate balance: stronger IPR with pro-competition PMR is used in many well-performing countries; reverse in under-performing countries
  - IPR measures must ensure quality of patents and promote diffsion (e.g., through licensing, research access).

Role of Foreign Investment

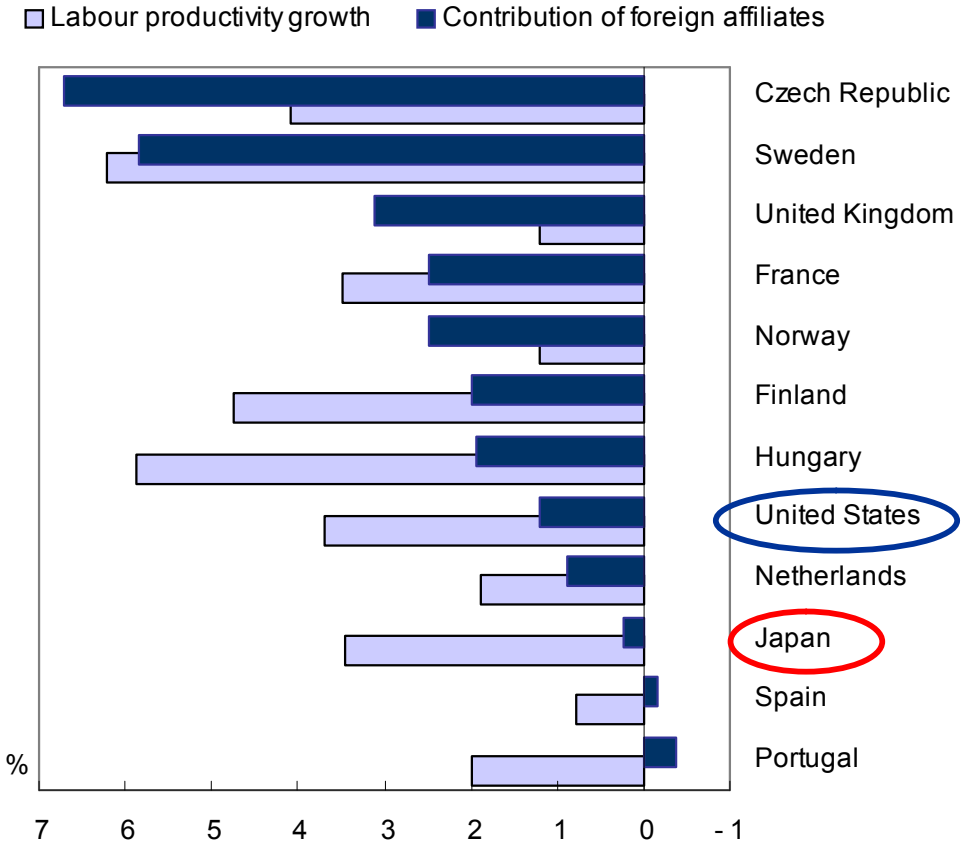
Inward FDI (per cent of GDP)



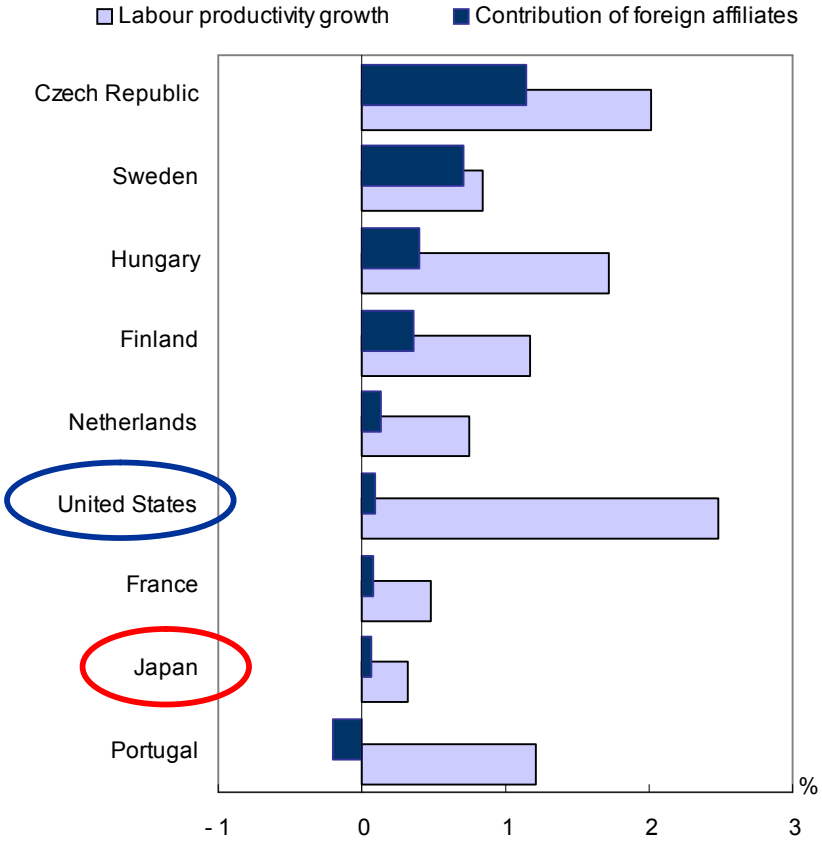
Source: OECD Economic Surveys – Japan (2004)

Contribution of multinationals to labour productivity growth, 1995-2001 (percentage points)

Manufacturing

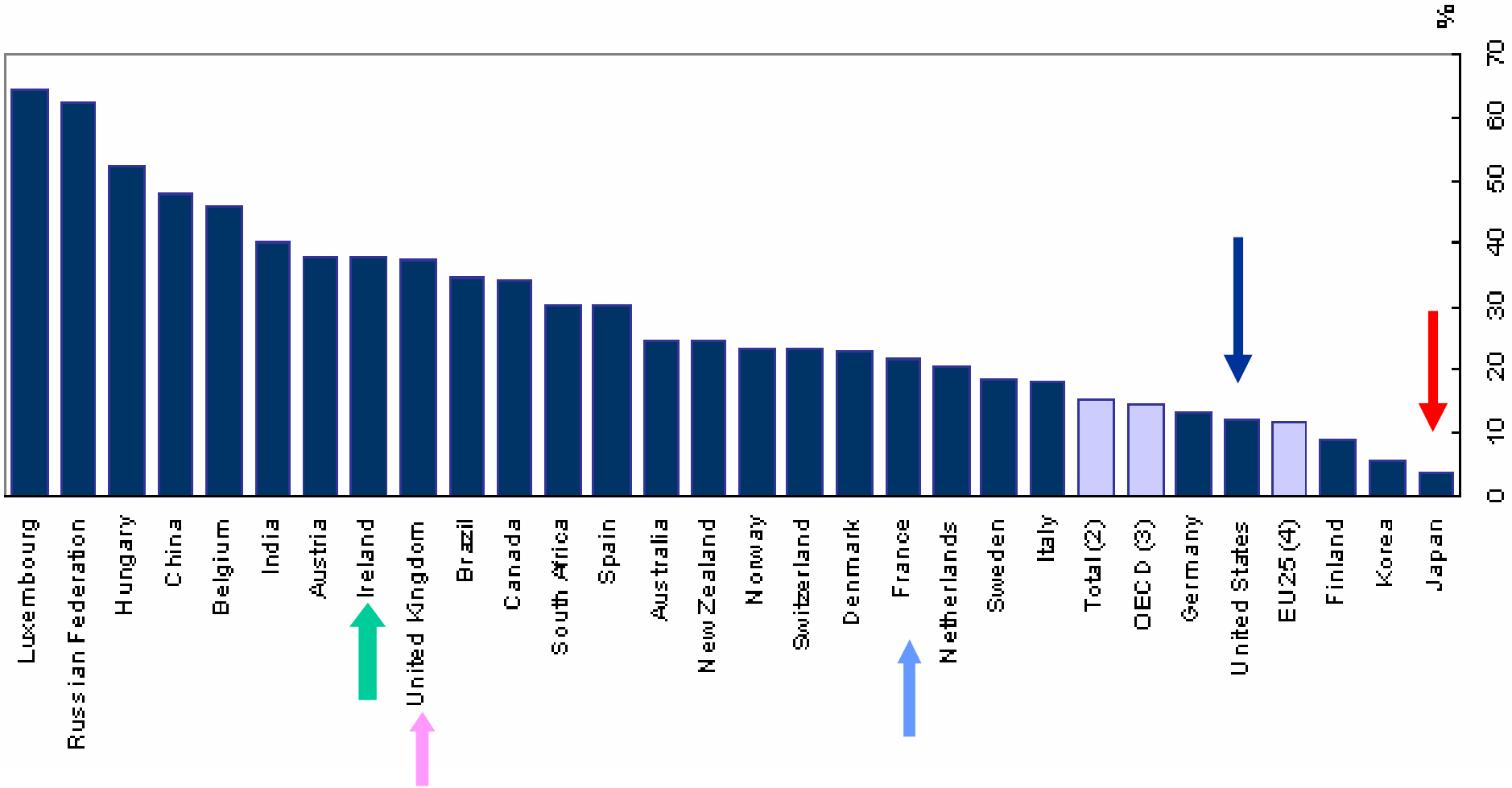


Services



Share of patents held by foreigners

Foreign ownership of domestic inventions, 1999-2001.

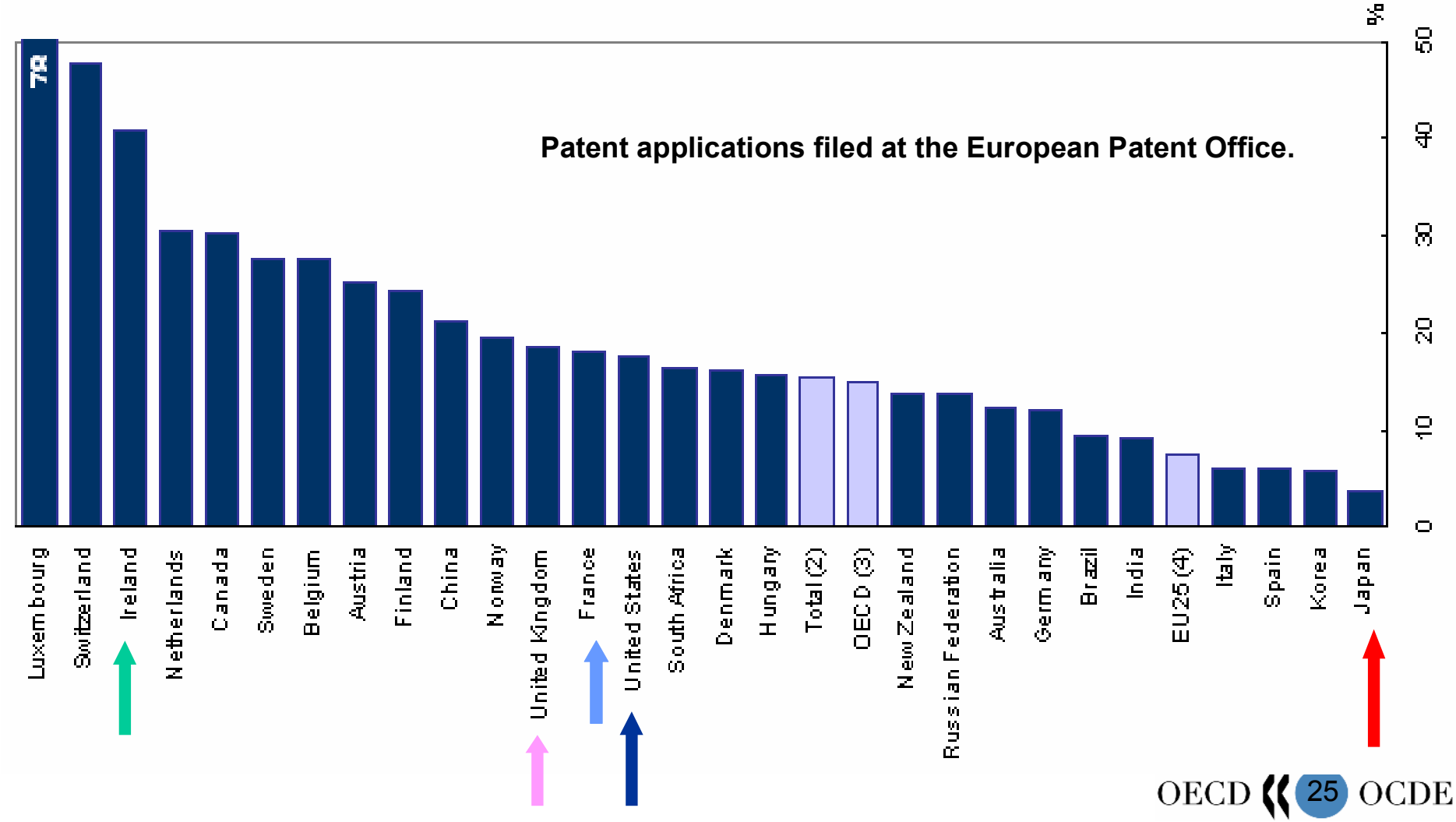


Patent applications filed at the European Patent Office.

Source: OECD, Patent database

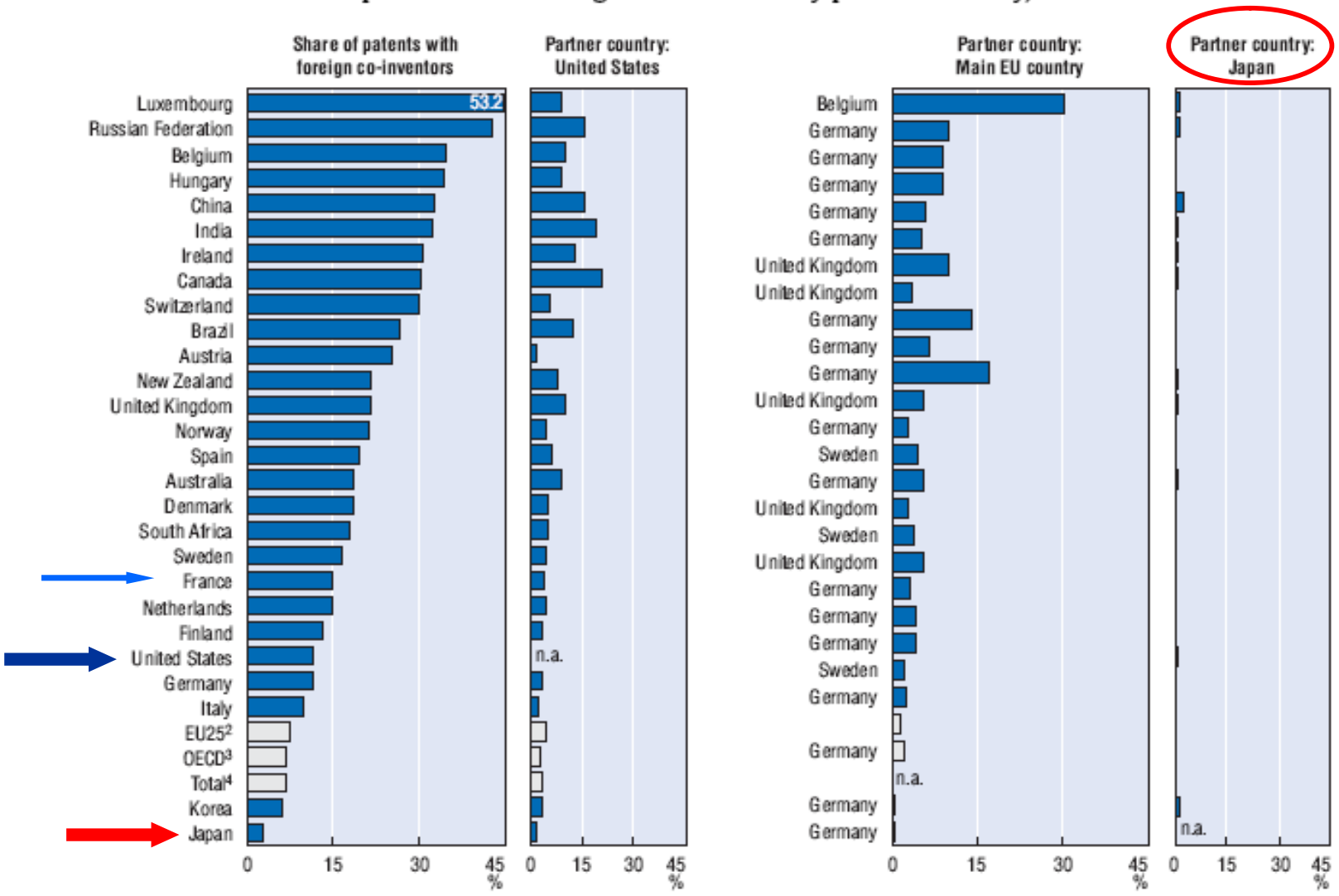
Share of patents registered abroad

Domestic ownership of inventions made abroad, 1999-2001.



Source: OECD, Patent database

Share of patents[1] with foreign co-inventors by partner country, 1999-2001



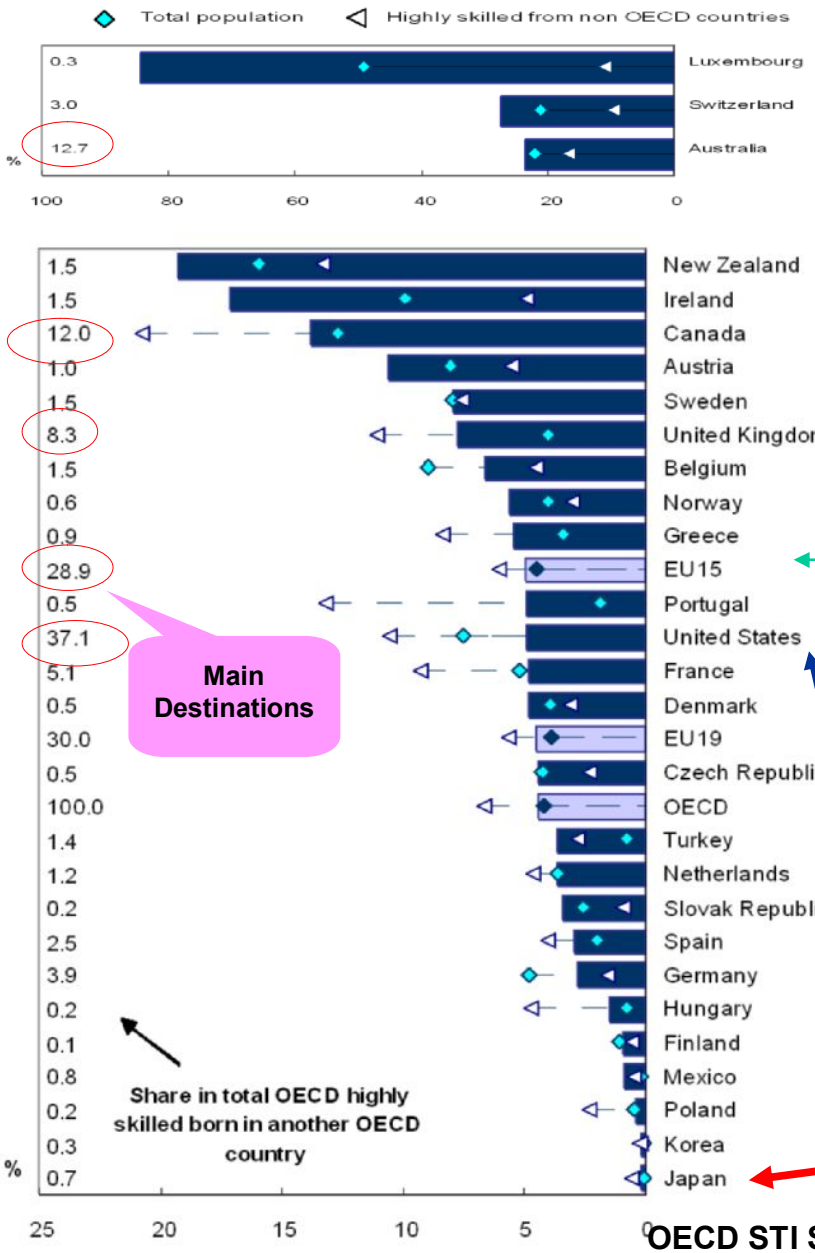
Note: Patent counts are based on the inventor's country of residence and the priority date.

1. Patent applications filed at the European Patent Office.
2. The EU is treated as one country; intra-EU co-operation has been netted out.
3. Patents of OECD residents that involve international co-operation.
4. All EPO patents that involve international co-operation.

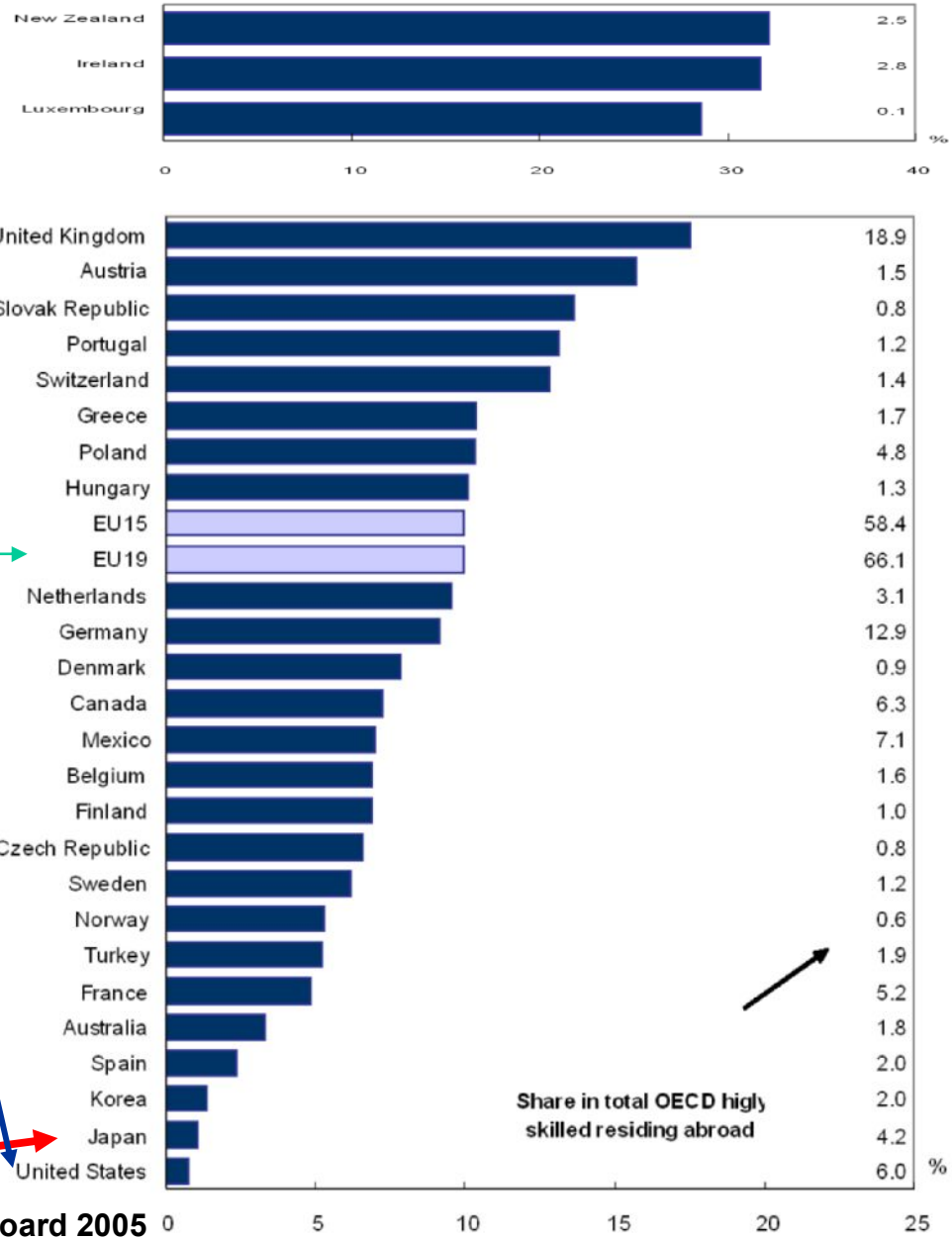
StatLink: http://dx.doi.org/10.1787/622567751004

Highly skilled Migrants

Immigrants as a % of highly skilled native population



Emigrants as a % of highly skilled in the country of origin



Innovation policies (Policy Indicators)
Governance of Public Research

- **Inter-ministerial coordination mechanisms** – to improve coordination of innovation policy mixes across broader set of ministries (S&T, industry, finance, health, etc.).
- **New priority-setting mechanisms** — broader participation of industry, research, and civil society, in addition to government
- **Changing funding models** — away from institutional funding toward competitive funding to improve quality and responsiveness of research
- **Revised evaluation methods** — for evaluating researchers, institutions and policies. Recognise quality and relevance of research. Ensure link to future funding.
- **New organisational models** — to promote multidisciplinary research, create critical mass and seed regional innovation.
- **Increasing autonomy** of public research institutions for hiring and promotion, entering into collaboration, etc.

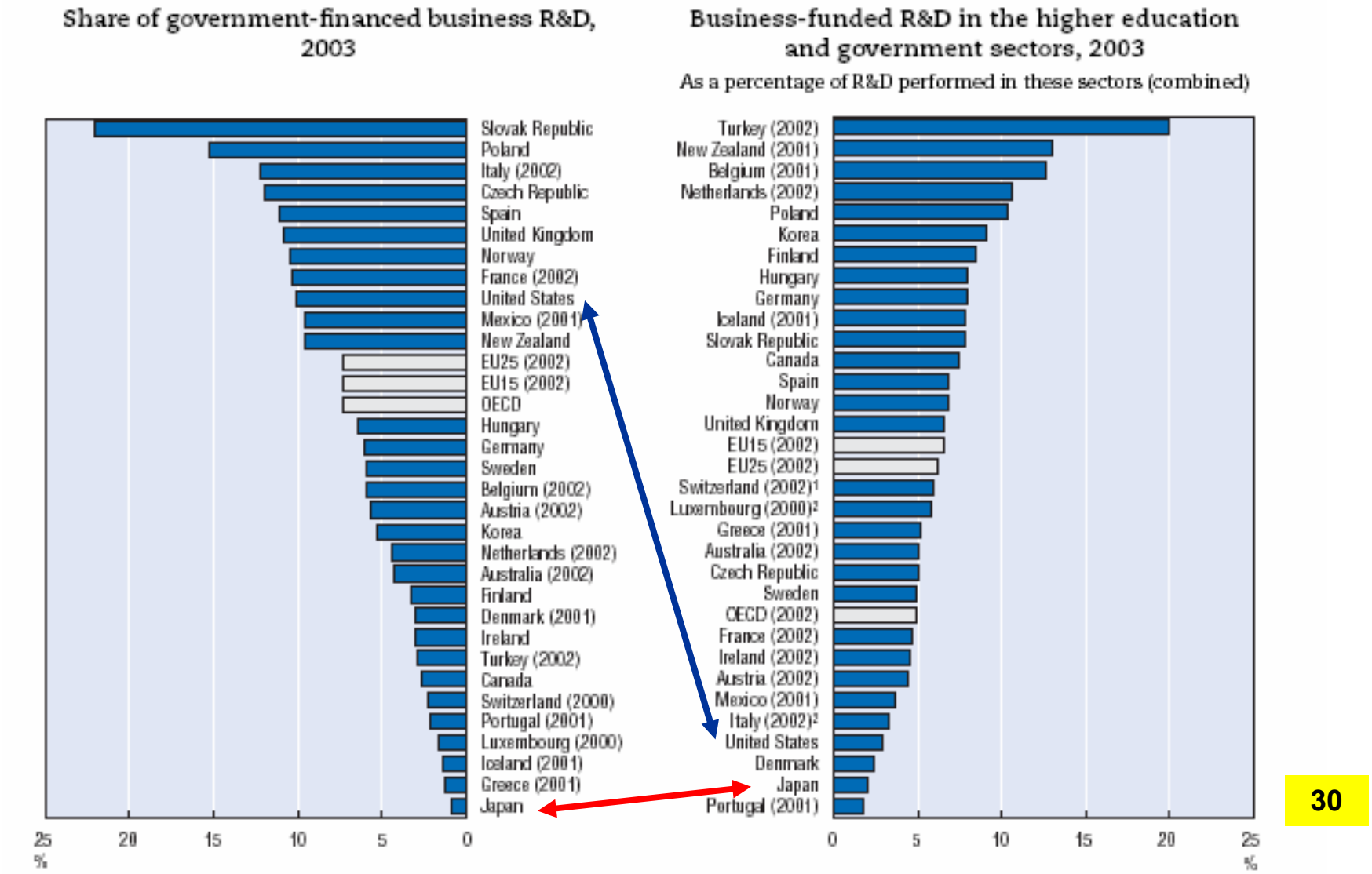
Innovation policies (Policy Indicators)
Industry-Science Linkage

- **Importance to innovation**
  - Improve match between public research and industry needs
  - Facilitate transfer of knowledge/technology to industry
- **Multiple channels**
  - Informal: publications, hiring of university graduates
  - Formalised: licensing of inventions, spin-offs from public research organisations, collaborative research, public/private partnerships
- **Policy measures**
  - Reforms governing the ownership of IPR resulting from publicly funded research.
  - Funding for commercialisation of public-sector technology and/or support of technology transfer offices
  - Establishment of public/private partnerships to share cost, risks and jointly determine objectives

R&D Linkage

Public to Private

Private to Public



1. Higher education sector only.
2. Government sector only.

OECD STI Scoreboard 2005

StatLink: http://dx.doi.org/10.1787/184805617807

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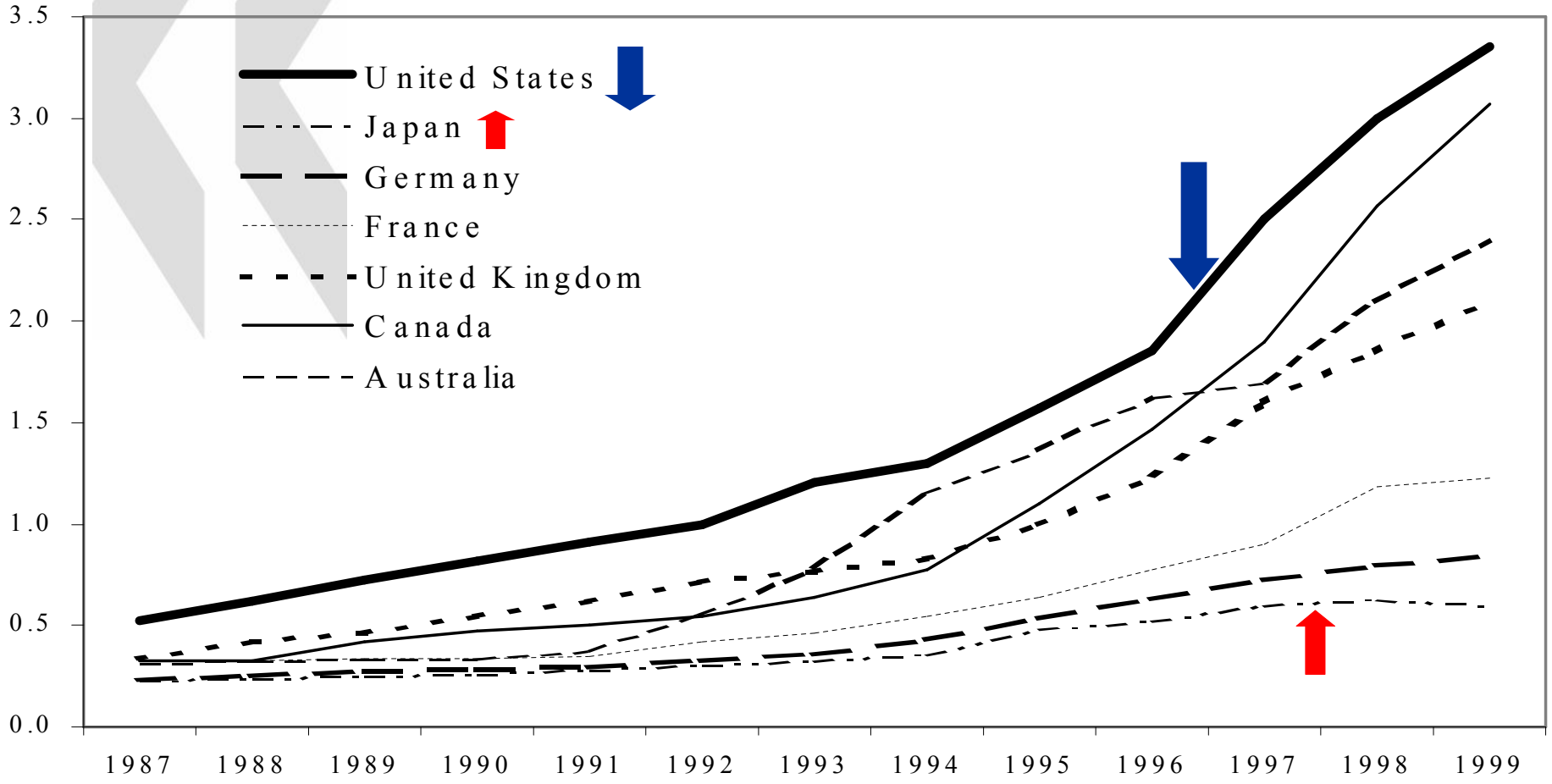
Science-industry links have developed rapidly in some countries

(Average number of scientific papers cited in patents taken in the US, by country of origin)



JAPAN

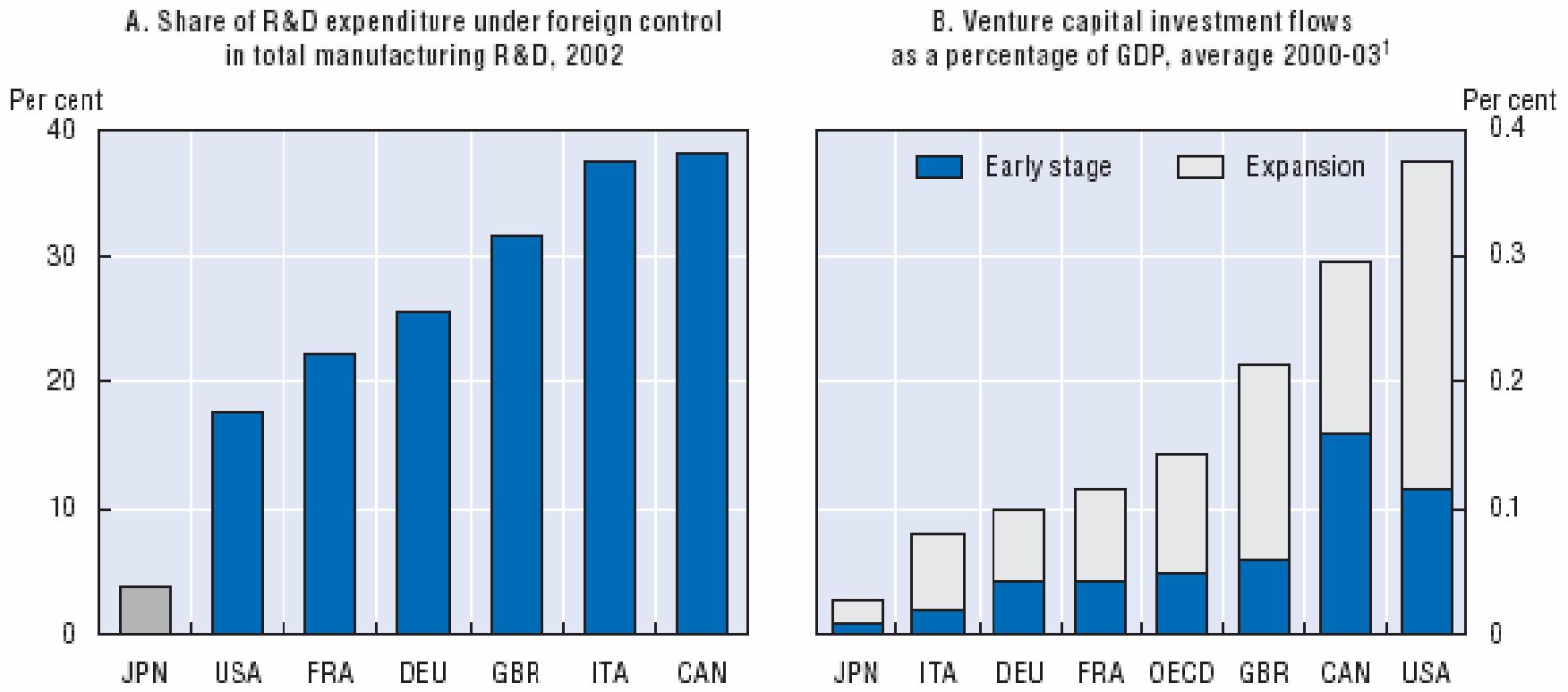
Japan performs above OECD average in terms of business R&D and patent intensities but shows weak performance in service sector innovation and limited openness to international knowledge transfers.

Indicator-based recommendations

- ***Further reduce barriers to foreign direct investment (FDI)***
- ***Improve access to early stage financing capital***

Other recommendations

- ***Strengthen industry-science linkages***
- ***Promote innovation in services & clusters***



1. 1998-2001 for Japan.

Source: Chart A: OECD, *Science, Technology and Industry Scoreboard*, 2005; Chart B: OECD, Venture capital database.

StatLink: http://dx.doi.org/10.1787/000000000000

Key Issue for Japan:

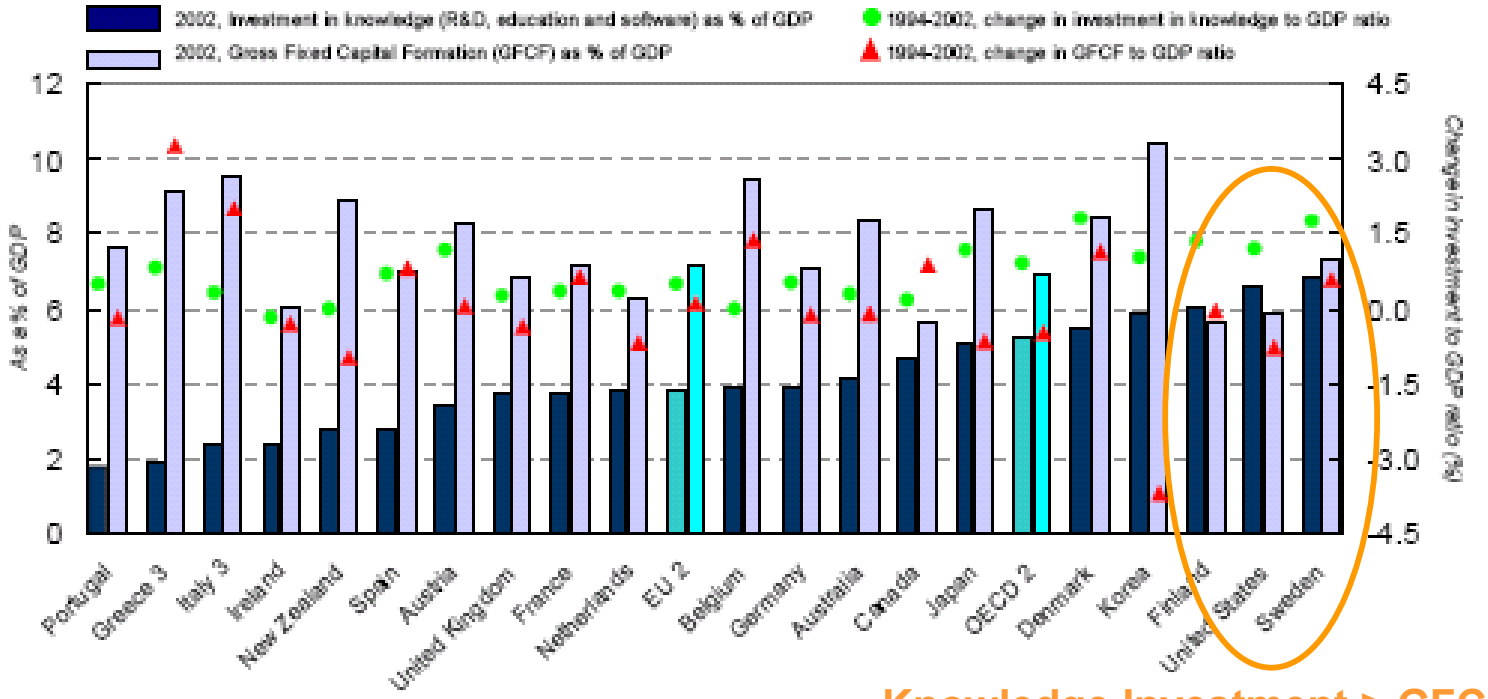
- ***How to extract economic values from high level of R&D investment in Japan***

→ ***Market Institution Building for Intellectual Asset-based Management***

- ***How to modify closed and self-contained innovation system in Japan***

Investment in knowledge is catching up for that in tangible capital.

Investment in knowledge versus investment in gross fixed capital formation

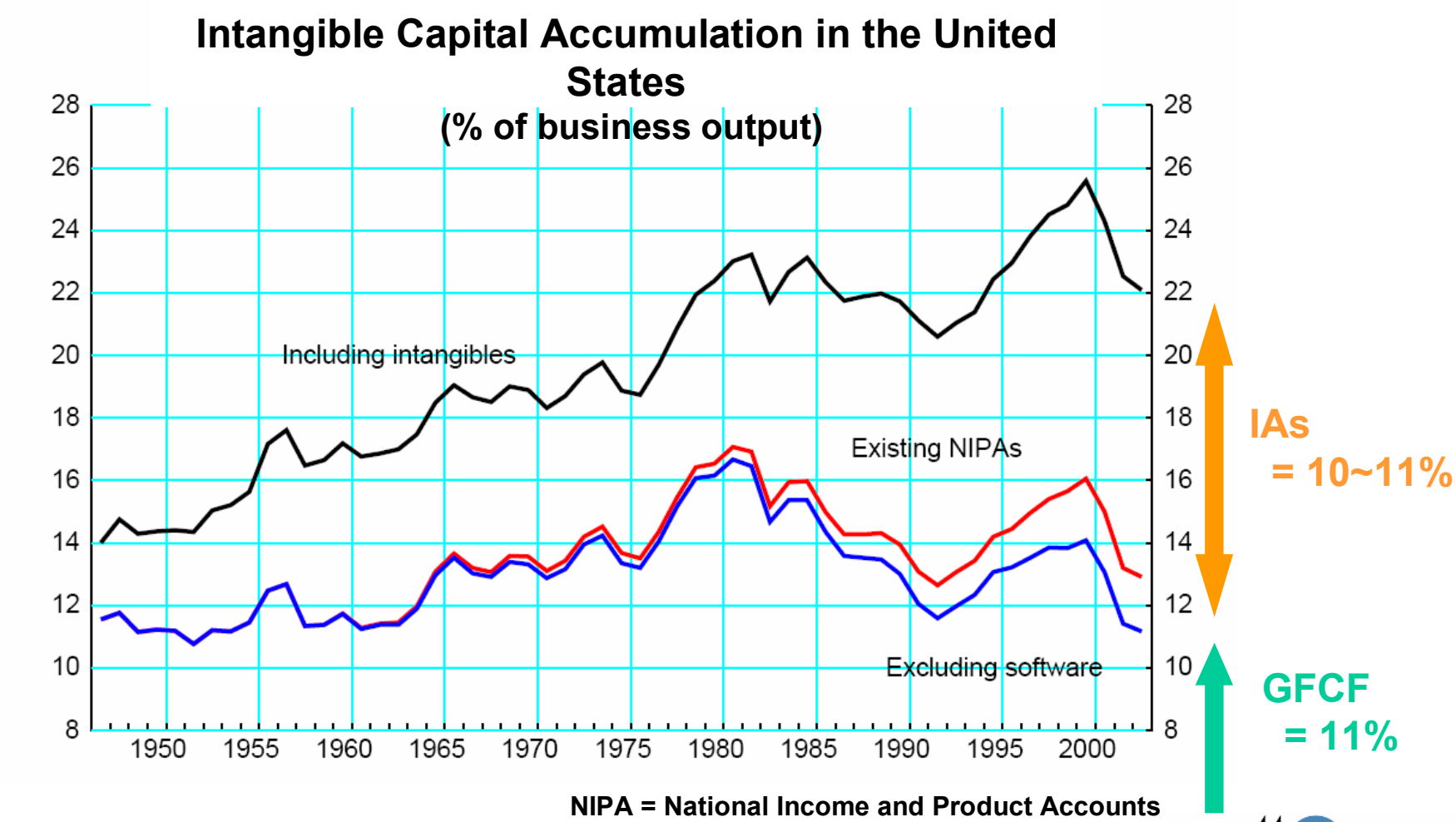


Knowledge Investment > GFCF

1. 1994-2001 for Greece and Italy. 1995-2002 for Korea. EU figure excludes Belgium, Greece and Italy. OECD figure excludes Belgium, Greece, Italy and New Zealand.
2. Excludes Greece and Italy.
3. 2001 data.

Source: *OECD 2005 Science, Technology and Industry Scoreboard* (OECD, 2005a).

In some countries intangible assets match fixed capital stock.



NIPA = National Income and Product Accounts

Source: Corrado, Huten & Sichel, 2004

Intellectual Assets should be developed, retained, and commercialised for value creation by firms.

Research & Development

Training Education

Back Office Spending Marketing Customer Relations…

Knowledge (IPR, Product, Process)

Human Resources (Skills, Creativity,..)

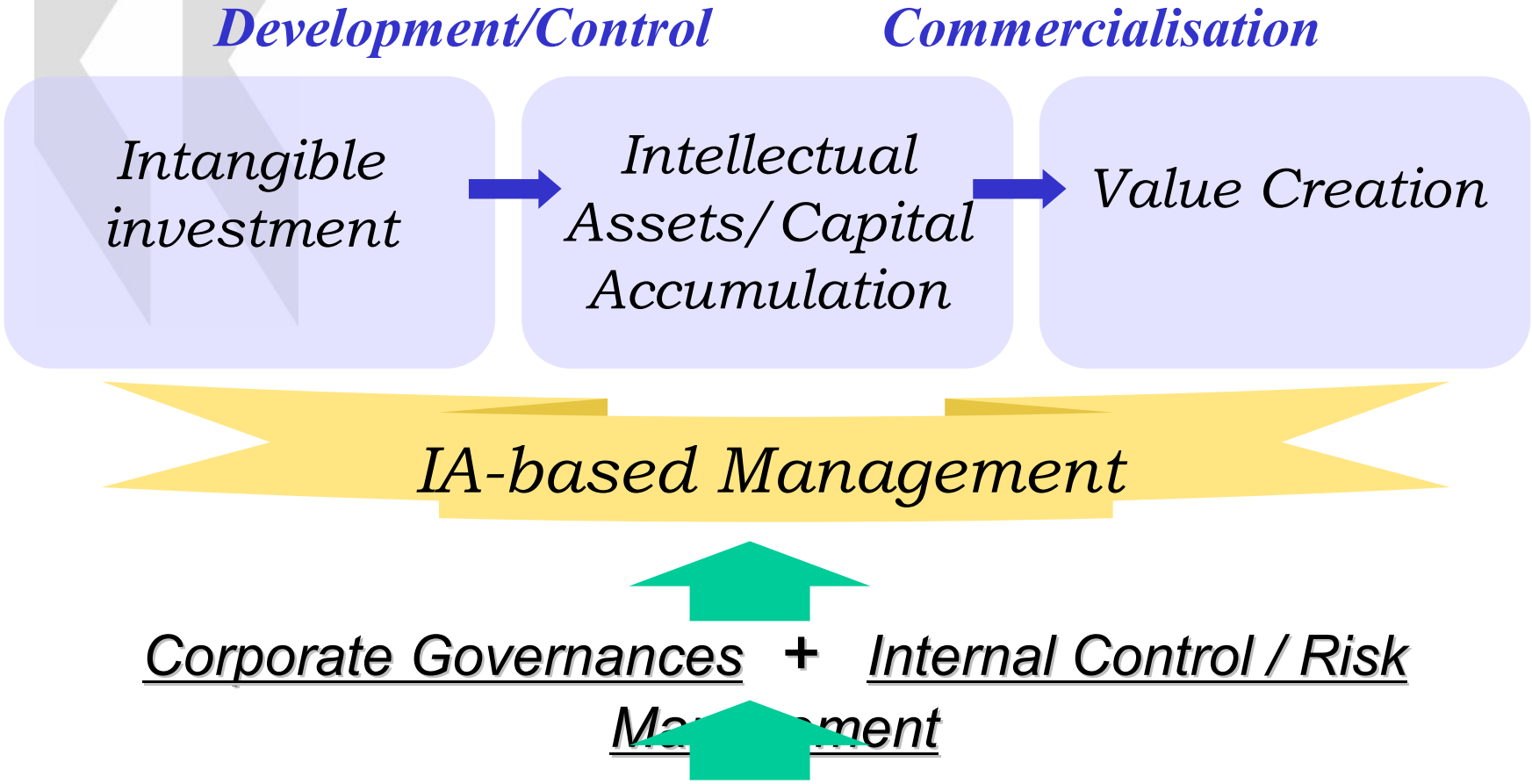
Organisation / Network Reputation / Brand

Market of IAs

Product Market

Productivity

The ability to create economic value from IAs is contingent on the firm's management capabilities.



Additional public disclosure on intellectual assets would enhance financial market efficiency.

Studies provide evidence that valuation in financial markets are influenced by disclosure on intellectual assets.

- A unit increase in R&D leads comparable increase in market valuation, greater than that for tangible investment.
- Stock price increase with FDA's approvals was doubled to 1% with qualitative info, and quadrupled with quantitative info.
- Companies with better general reporting in line with PWC's benchmark enjoyed a lower cost of capital.
- The link between corporate transparency and stock price volatility is stronger for smaller companies.

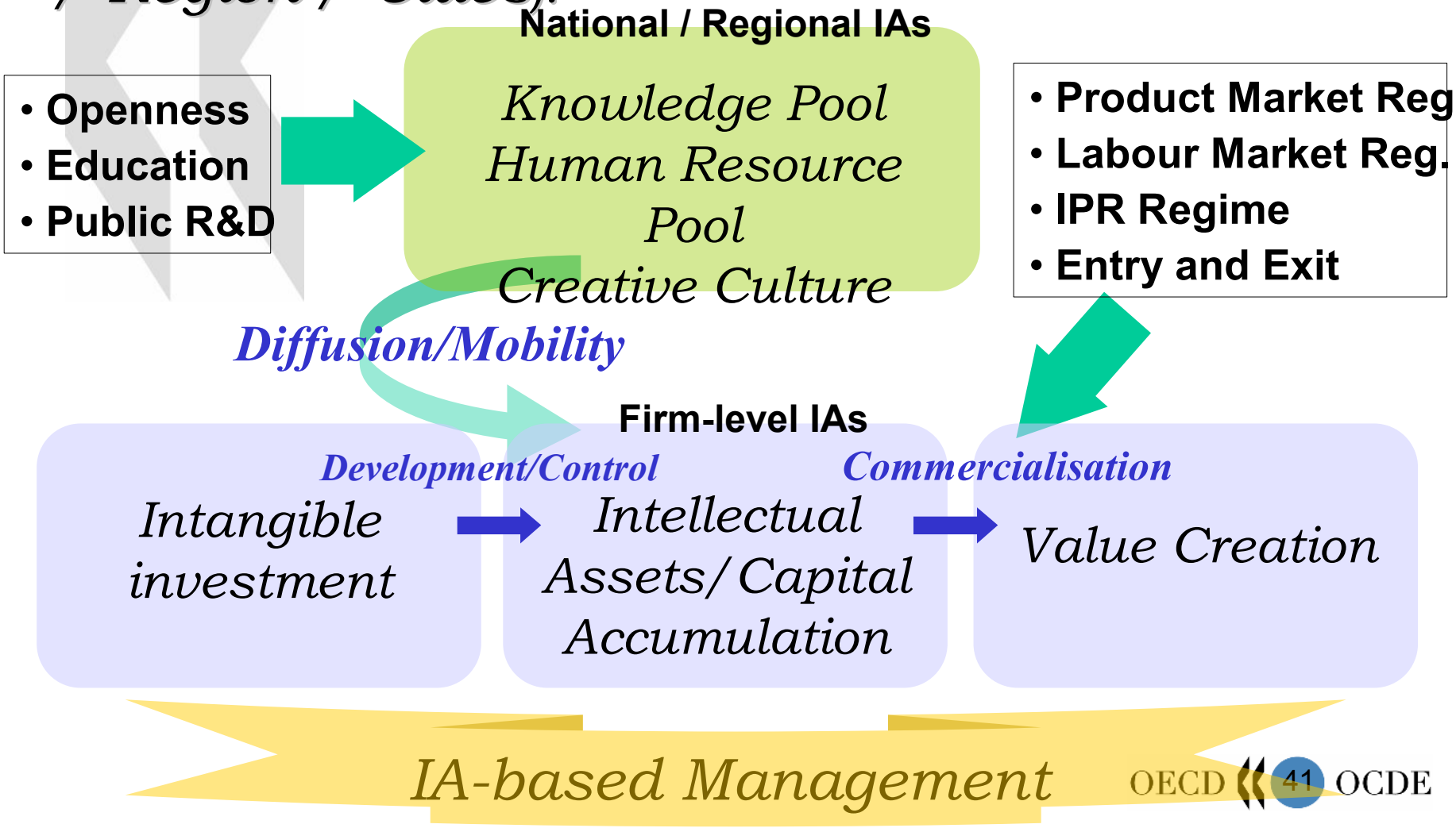
Growing number of initiatives address to disclosure of intellectual assets.

Selected Frameworks and Guidelines of reporting on IAs

Institution/Country	Scope	Year	Reference
Narrative/non-financial reporting			
European Union	All companies	2003	Modernisation Directive (4th and 7th Directives)
	Listed companies	2004	Transparency Directive
Australia	Listed companies	2003	ASX Listing Rule, Australian Stock Exchange
Canada	Listed companies	2003	Continuous Disclosure Obligations, Sec. Admin.
Germany	All companies	2004	GAS 15 Management Reporting, DRSC
United Kingdom	Quoted companies	2005	Operating and Financial Review, DTI
United States	Listed companies	2003	Management Discussion and Analysis, SEC
Specific reporting about intellectual assets			
European Union	All companies	2002	Guidelines on Intangibles, MERITUM Project
Australia	All companies	2002	Guiding Principles on Extended Performance Management
Austria	Public universities	2002	Austrian Universities Act
Denmark	All companies	2003	Intellectual Capital Statements, MSTI
Germany	SME	2004	Intellectual Capital Statement, BMWA
Japan	All companies	2005	Guidelines for Disclosure of IA-based Management, METI

Source: OECD

Ability to create economic returns from intellectual assets also depends upon economy-wide business environments (→ IAs for Nation / Region / Cities).



Key Issue for Japan:

- ***How to extract economic values from high level of R&D investment in Japan***
- ***How to modify closed and self-contained innovation system in Japan***

→ ***Further opening of Japanese Economy especially its Innovation System***

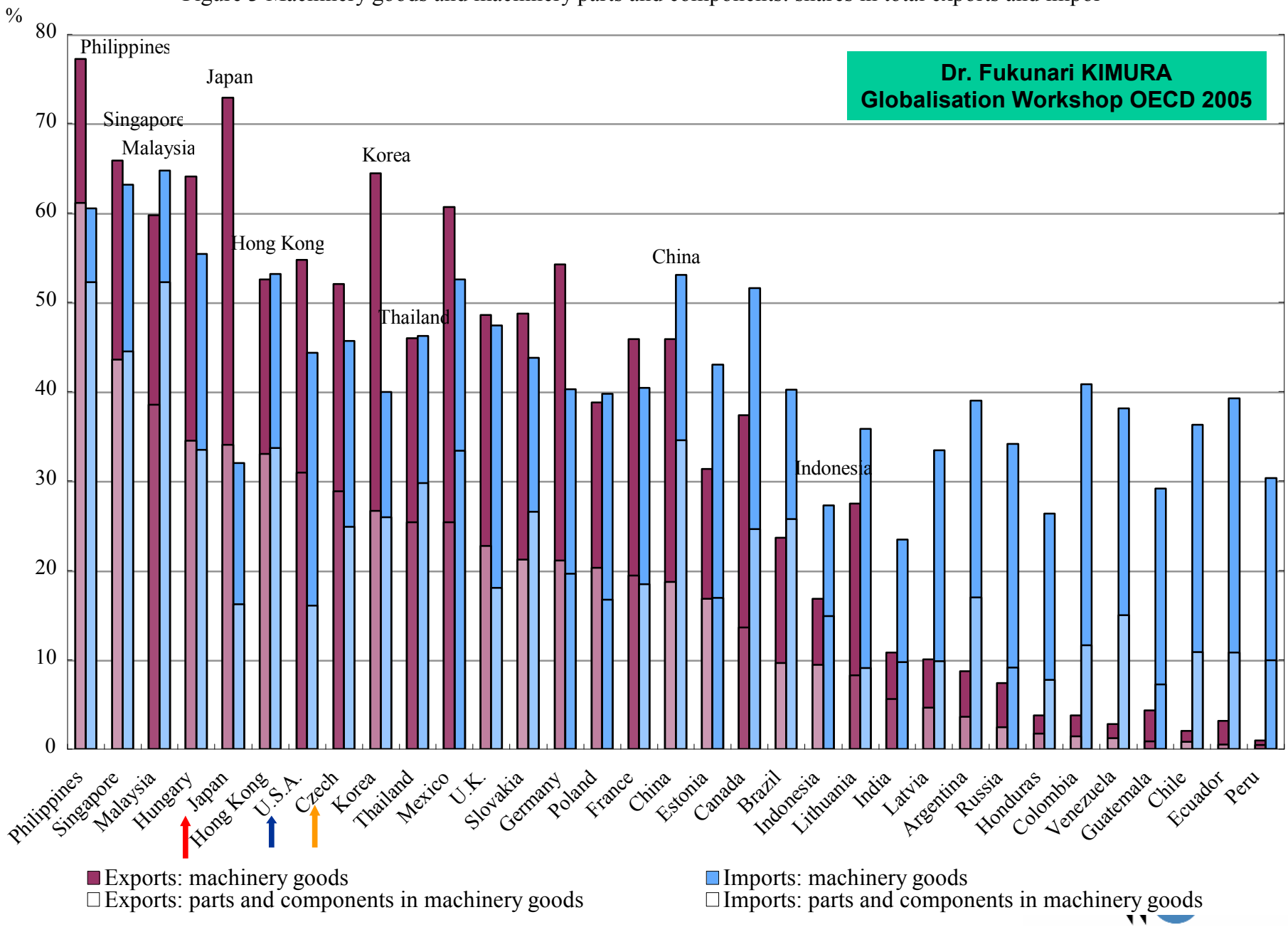
Openness is increasingly important in global economy: the case of innovation

- **1% more in business R&D generates 0.13% in productivity** （The effect has increased since 1980 The effect is larger in R&D intensive countries）
- **1% more in public R&D generates 0. 17% in productivity** （The effect is larger in countries where business R&D intensity is higher）(higher education is important)
- **1% more in foreign R&D generates 0.45% in productivity** （The effect is larger is smaller countries. The effect is larger in R&D intensive countries: only own efforts allow any country to learn from others.）

SO KEEP YOUR SYSTEM OPEN and WORK TOGETHER with OTHERS!!

Source: STI WP 2001/3 by D. Guellec

Figure 3 Machinery goods and machinery parts and components: shares in total exports and impor

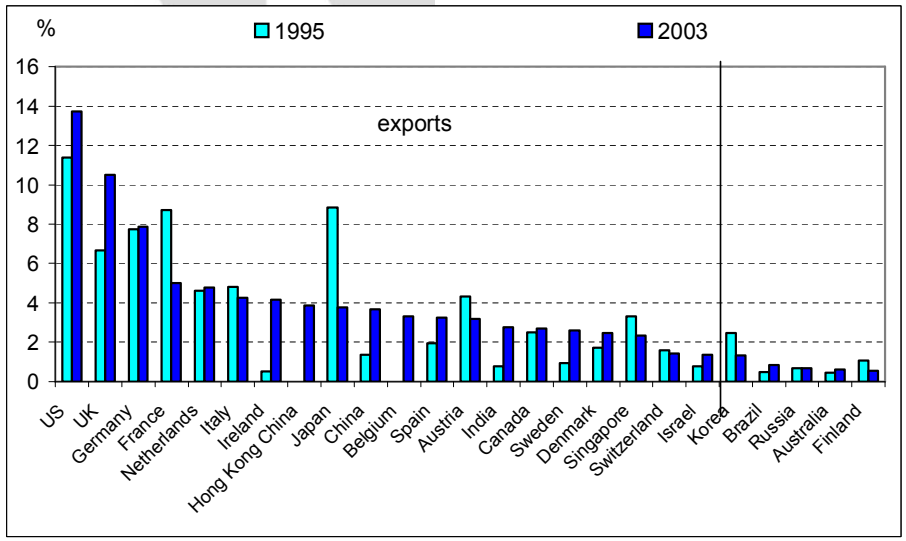


Source: Ando and Kimura (2005b).

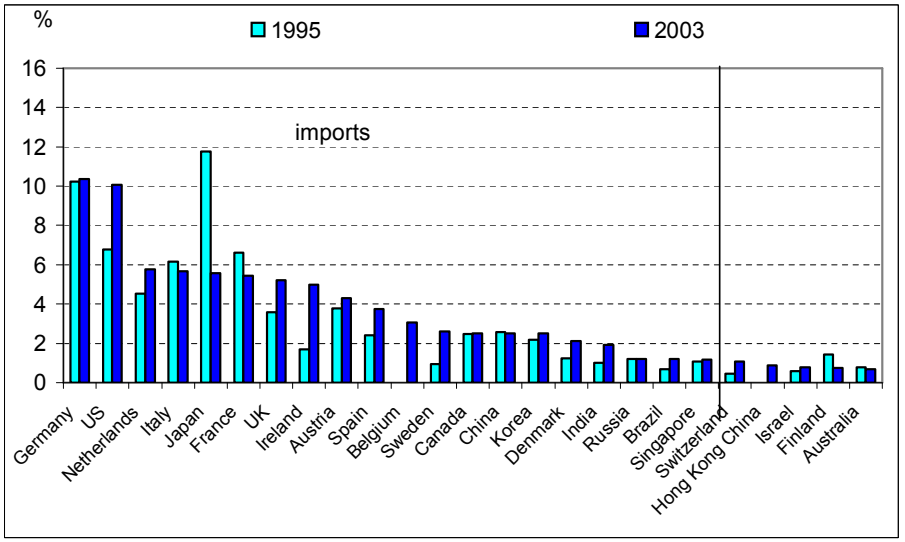
Globalisation of Information Related Services

Shares of reported exports and imports of “other business services” and “computer and information services” for the top 20 country and selected other countries, 1995 and 2003 (Current US$)

Exports



Imports



Restructuring or Boneyard:
The Need for Speed

While restructuring our Company in the 1980s, we spent much of our time talking about the accelerating pace of change: in world politics, in technology, in product introduction and in the increasing demands of customers. We don't have to do that anymore. Change is in the air. Newspapers and networks hammer it home daily. GE people today understand that pace of change, the need for speed, and the absolute necessity of moving more quickly in everything we do, from inventory turnover, to product development cycles, to a faster response to customer needs. They understand that slow-and-steady is a ticket to the boneyard in the 1990s.

"To Our Share Owners" (1990 Annual Report) of GE

Thank you

For further information:

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