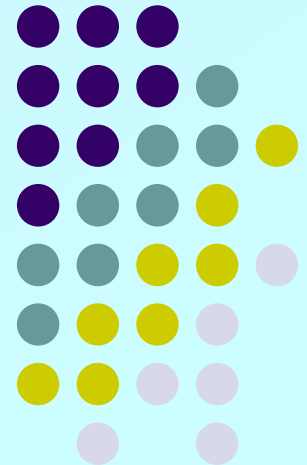


Study for Evaluating the Achievements
of the S&T Basic Plans in Japan:

Qualitative Analysis of R&D Output

NISTEP International Workshop on
Comprehensive Review of
Japan's Science and Technology Basic Plans
Tokyo, Japan
September 13 - 14, 2004

Hiroyuki TOMIZAWA
National Institute of Science and Technology Policy (NISTEP)





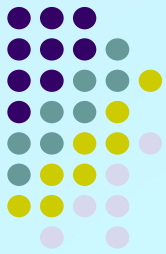
Basic idea

- Input-Output model
 - R&D output as an indicator of performance
 - Oversimplification?
- Structural analysis
 - To illustrate the influence of the S&T Basic Plans on Japanese R&D system
 - Analysis of “structural data”
 - year, sector (type of organization), citation frequency rank, research field, ...



Difficulties of the study

- How can we measure “additionality” of the S&T Basic Plans ?
- Premature for Output Analysis ?
 - 1st S&T Basic Plan: 1996-2000
 - 2nd S&T Basic Plan: 2001-2005



Database

- Scientific Papers

SCI (Science Citation Index)

- *National Science Indicators* Macro Analysis
- *SCI CD-ROM* Structural Analysis
- *Web of Science, etc.* Impact Analysis

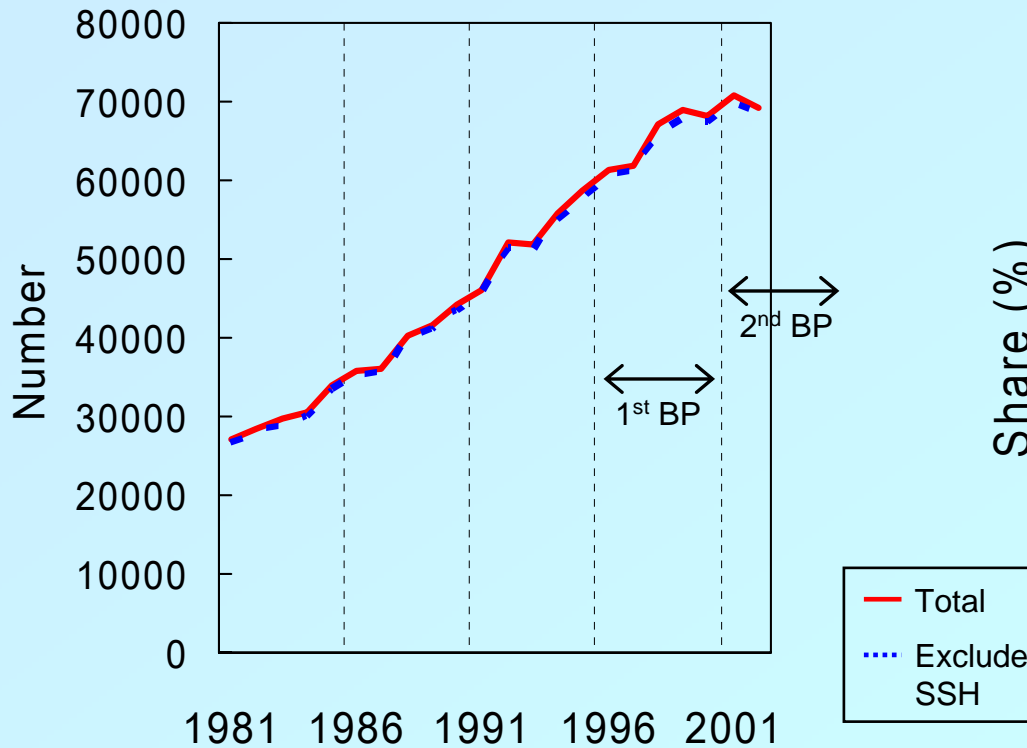
- Patent

- *CHI International Technology Indicators* US Patent, Citation, Science Linkage
- *WIPO and Patent Office* Patent Applications

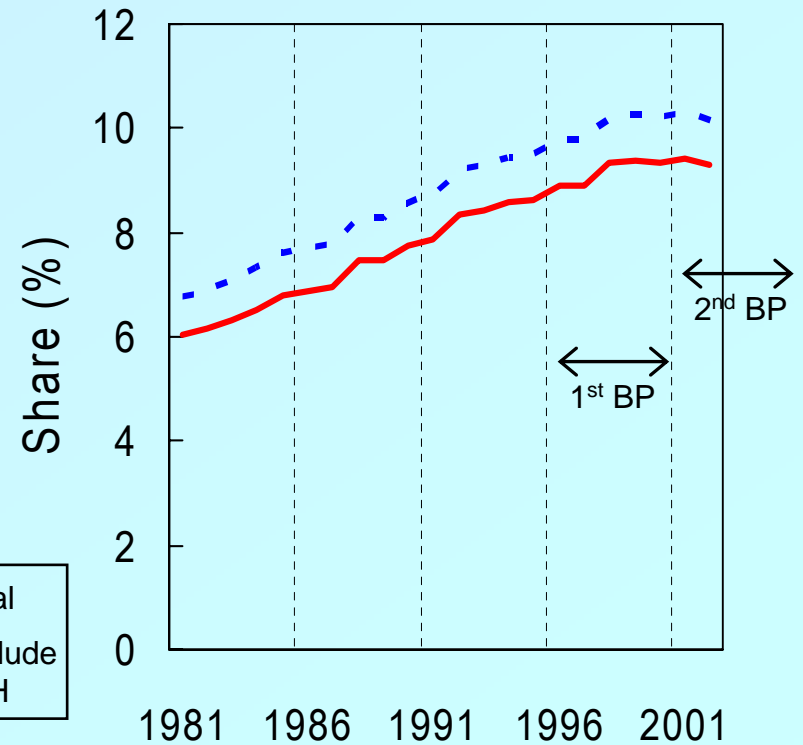


Trends of Japan's scientific papers

Number of Scientific Papers

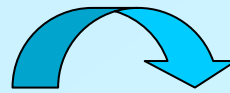
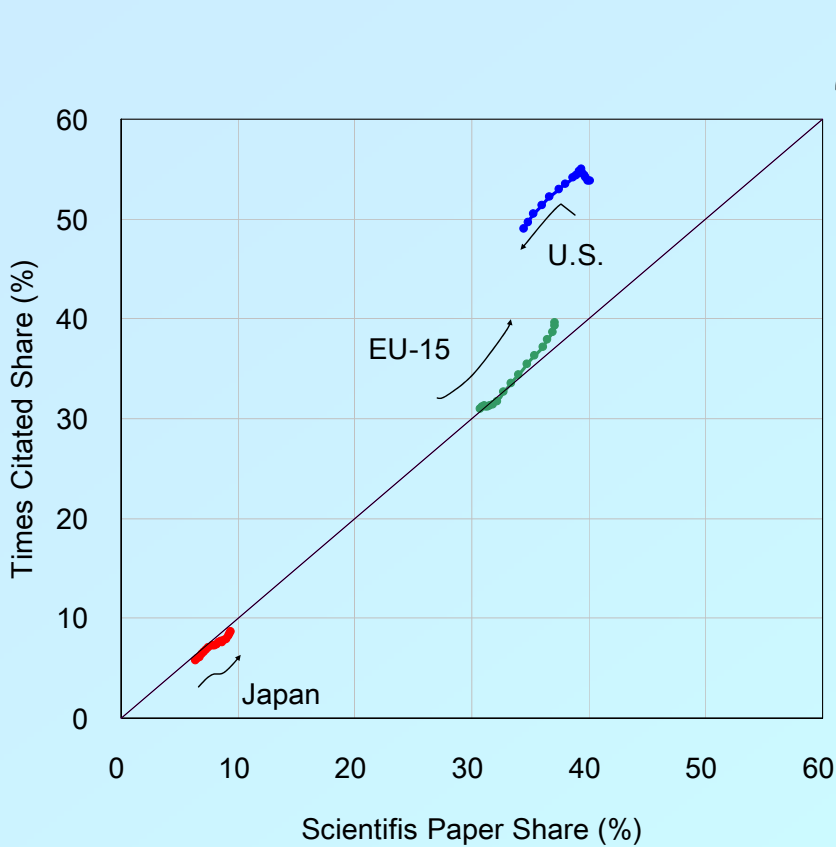
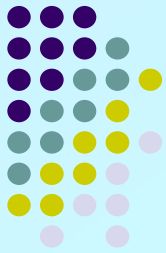


Share of Scientific Papers

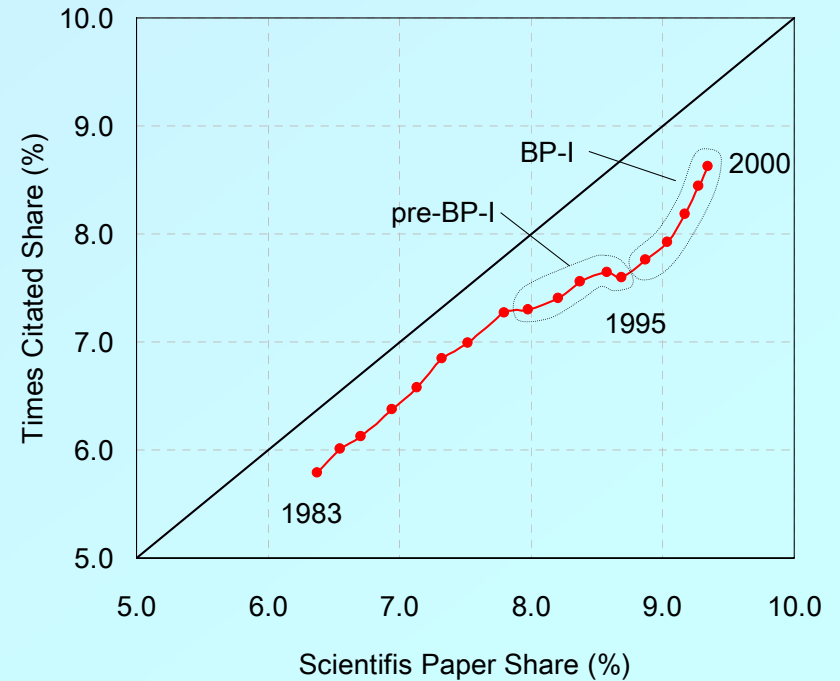


Data: Thomson ISI, National Science Indicators 1981-2002.

Scientific paper share and times cited share

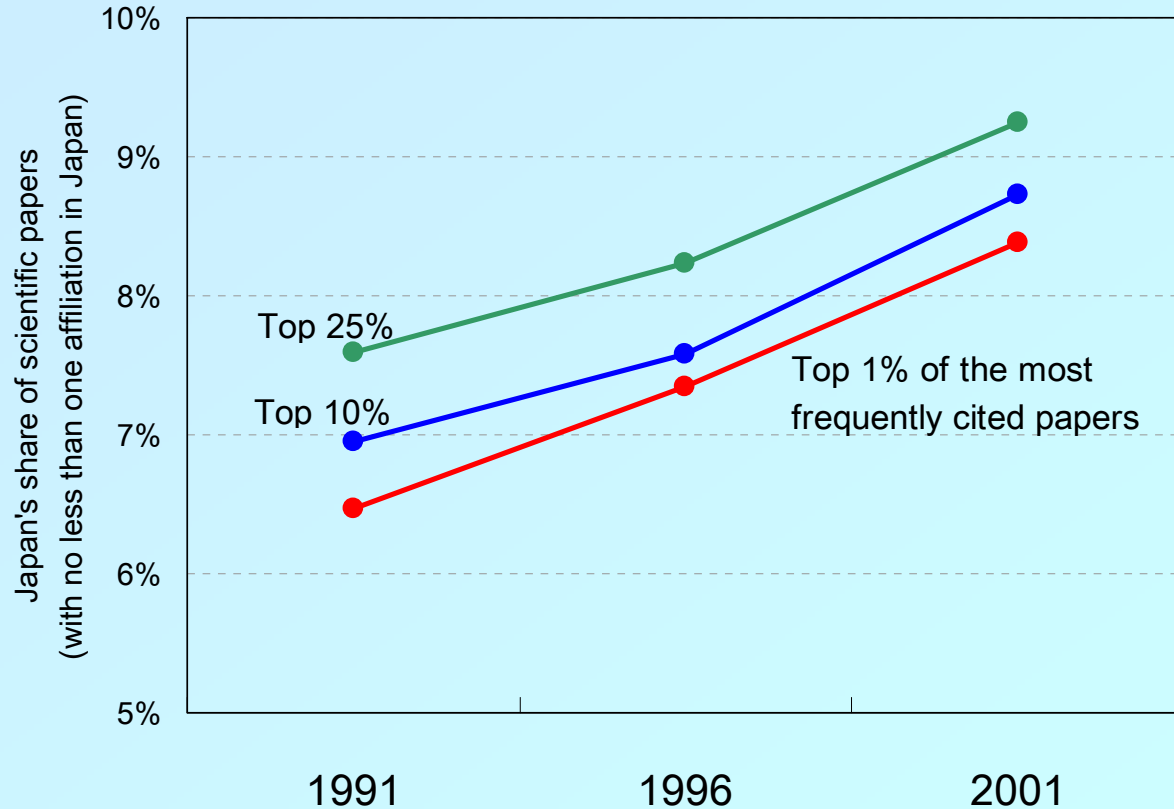
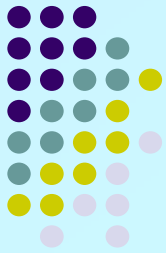


(Enlarged figure about Japan)



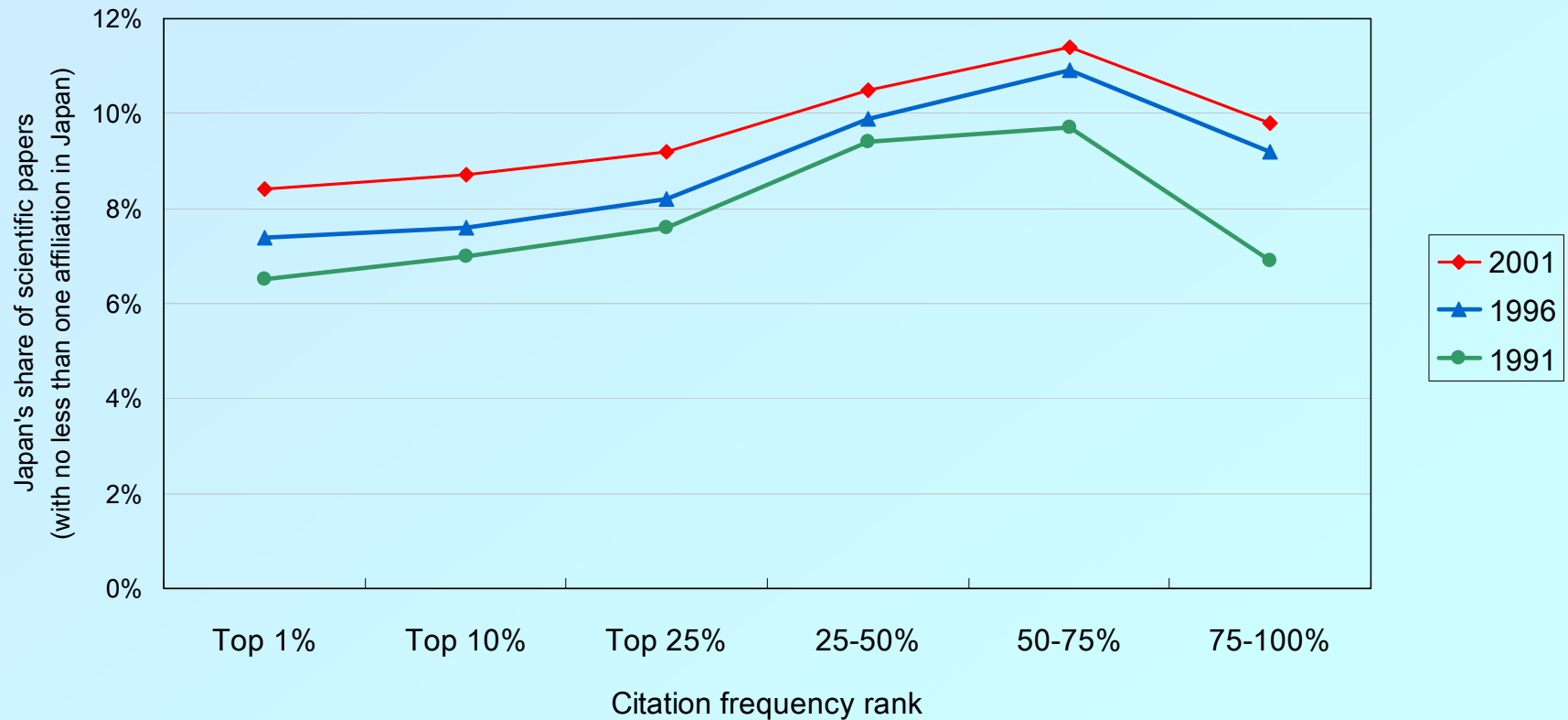
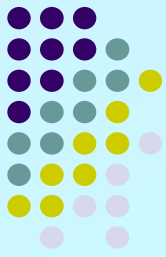
Data: Thomson ISI, National Science Indicators 1981-2002.

Number of scientific papers by citation frequency rank



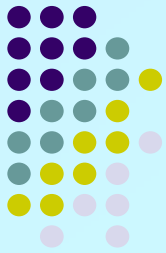
Note: Citation frequency is calculated based on SCI up to 2003.
Data: Thomson ISI, Science Citation Index (CD-ROM version).

Number of scientific papers by citation frequency rank

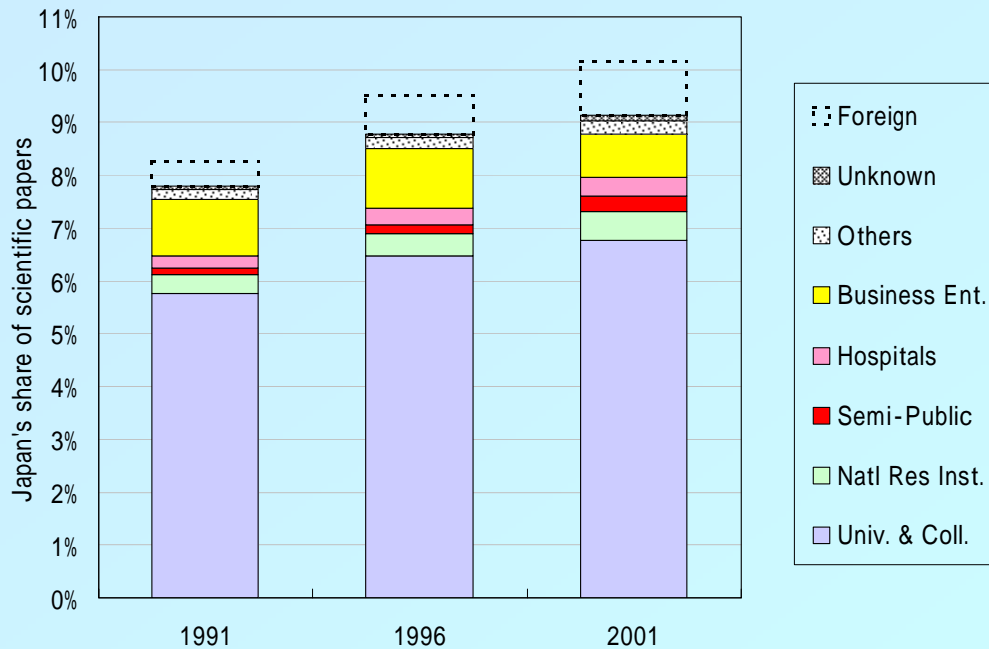


Note: Citation frequency is calculated based on SCI up to 2003.
Data: Thomson ISI, Science Citation Index (CD-ROM version).

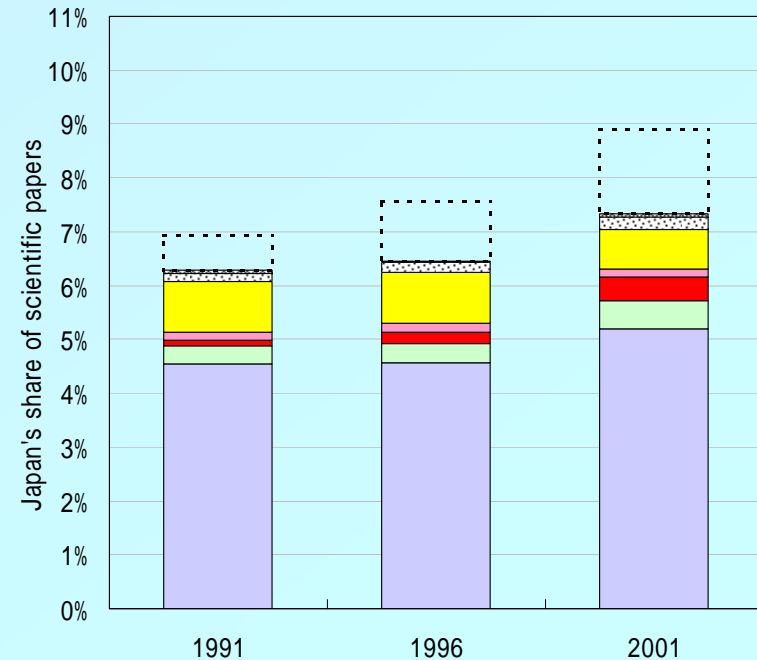
Japan's share of scientific papers by citation frequency rank and by sector



Whole

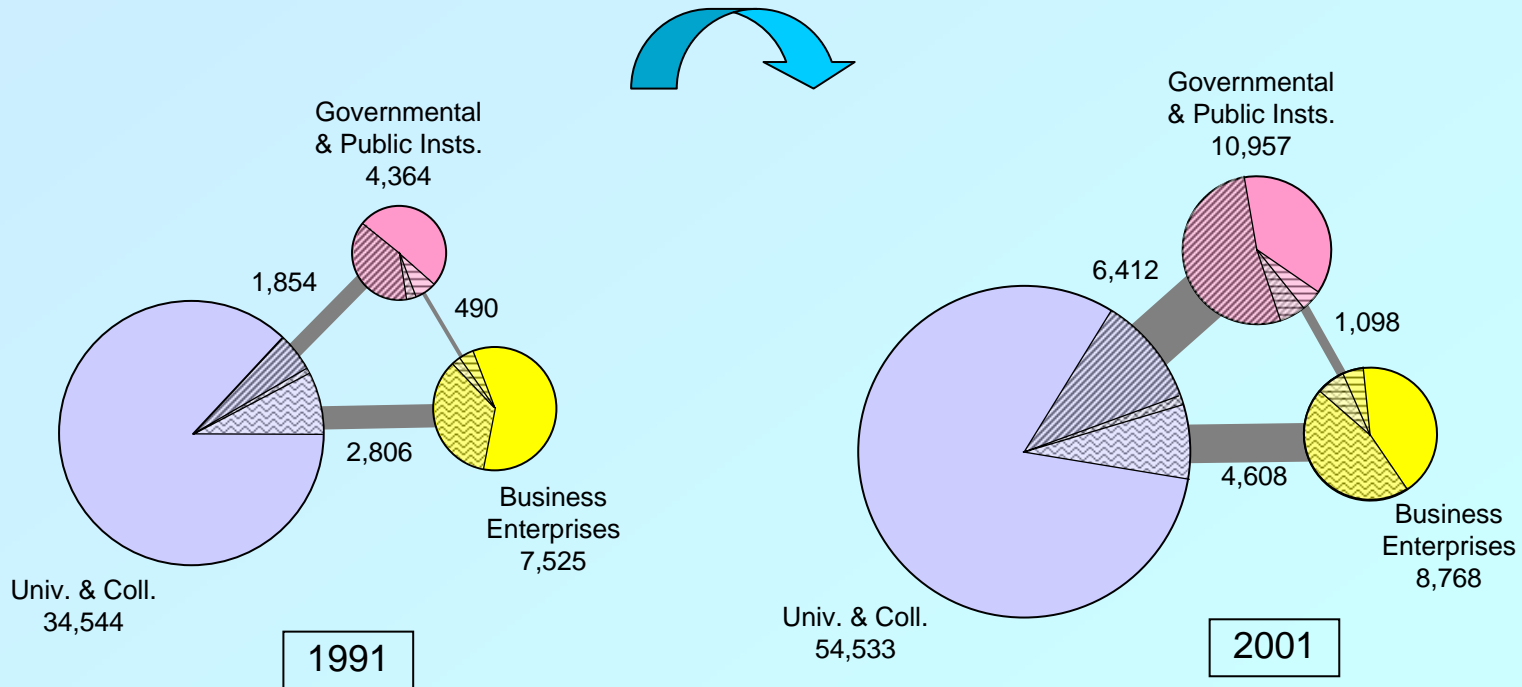


Top 10% of the most frequently cited



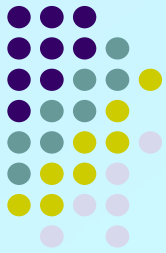
Note: Inter-sectoral co-authored papers are counted in fractional base.
 Data: Thomson ISI, Science Citation Index (CD-ROM version).

Co-authorship structure of Japan's scientific papers

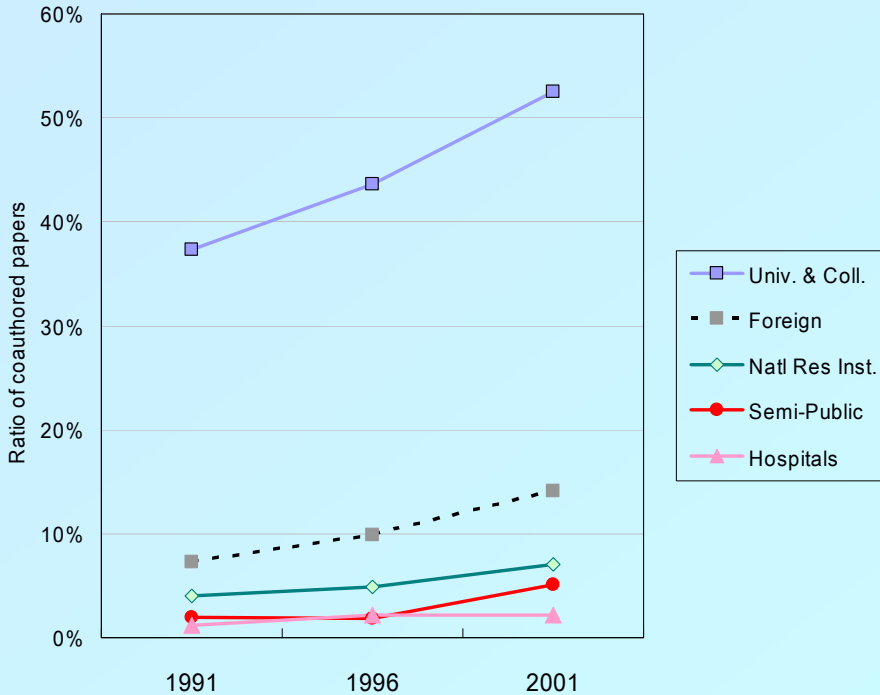


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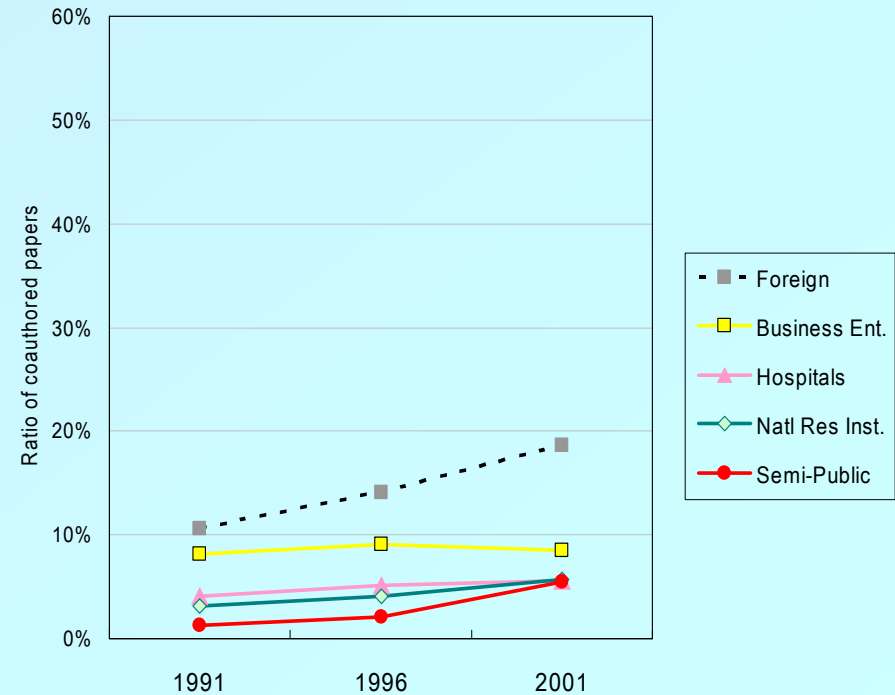
Trends of the inter-sectoral co-authorship



Business enterprise sector with other sectors

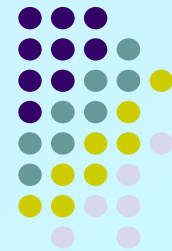


University & college sector with other sectors

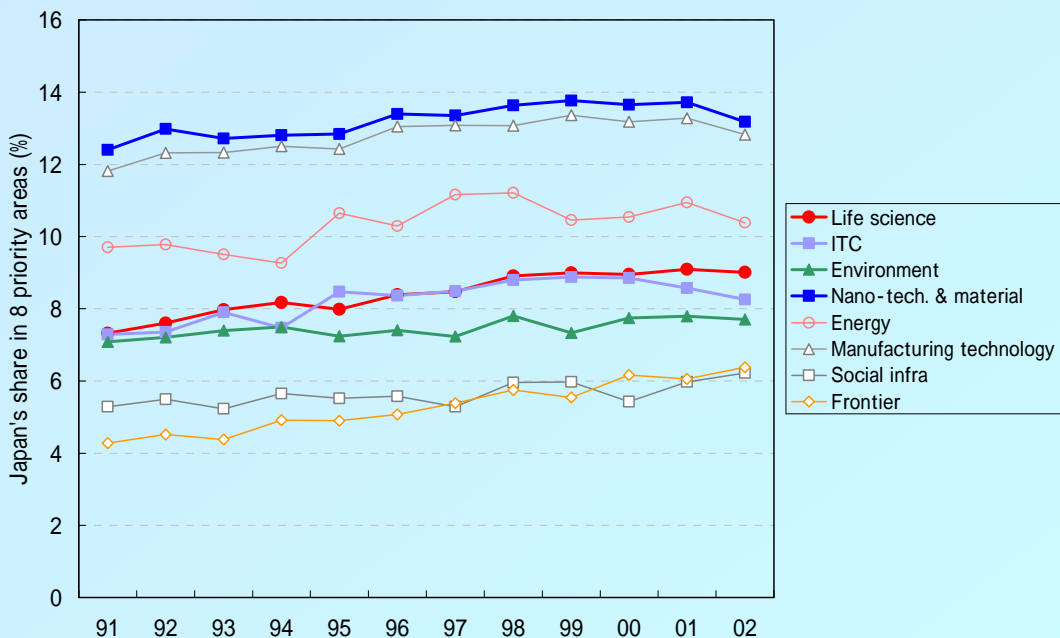


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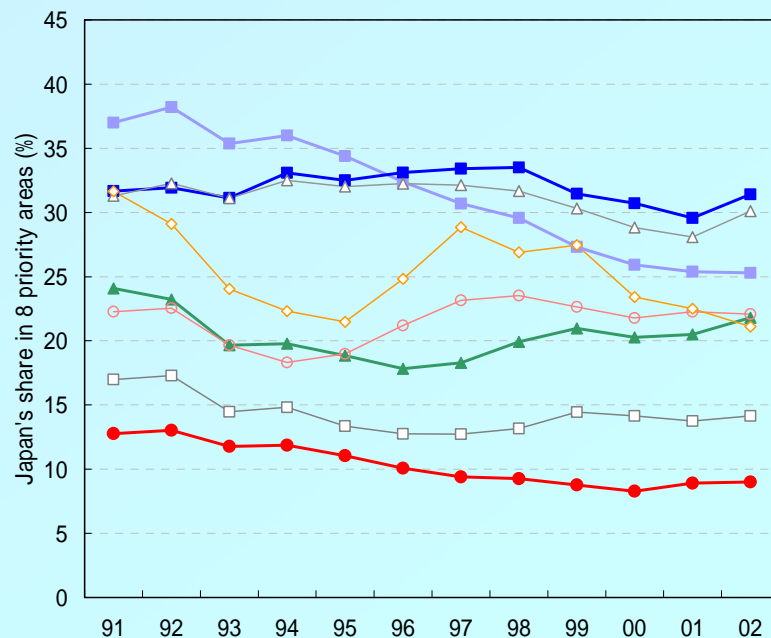
Scientific Papers and Patents by Priority Area



Scientific papers

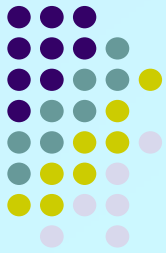


U.S. patents



Data: Thomson ISI, National Science Indicators 1981-2002.
 CHI Research Inc., International Technology Indicators 1980-2002.

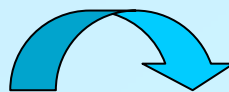
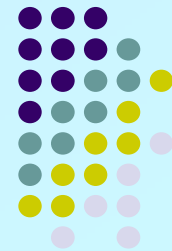
Scientific Publication Growth: by Growth Pattern of the World and Japan



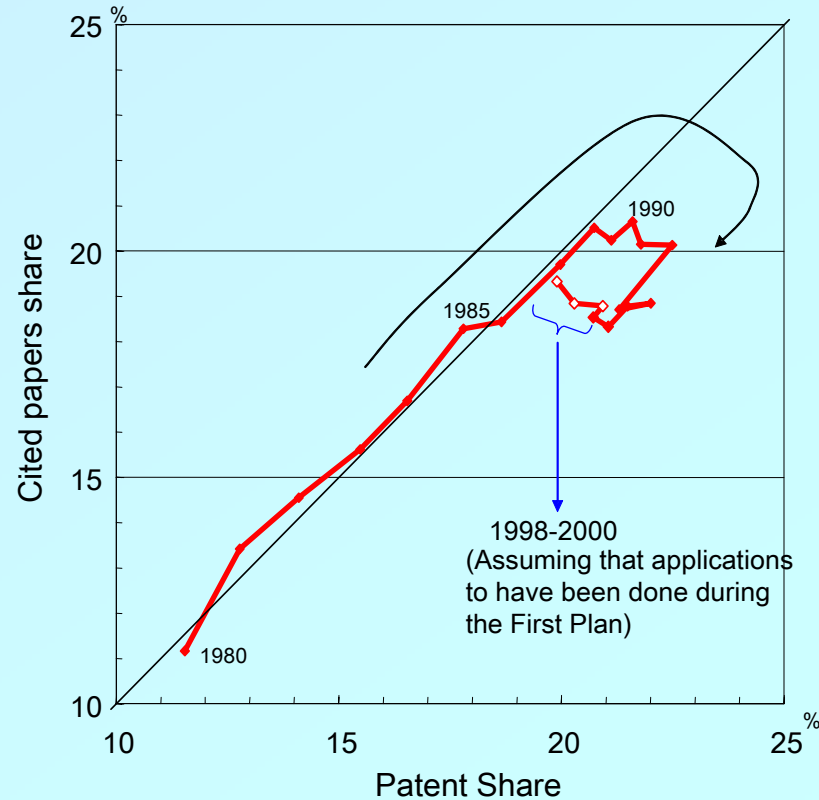
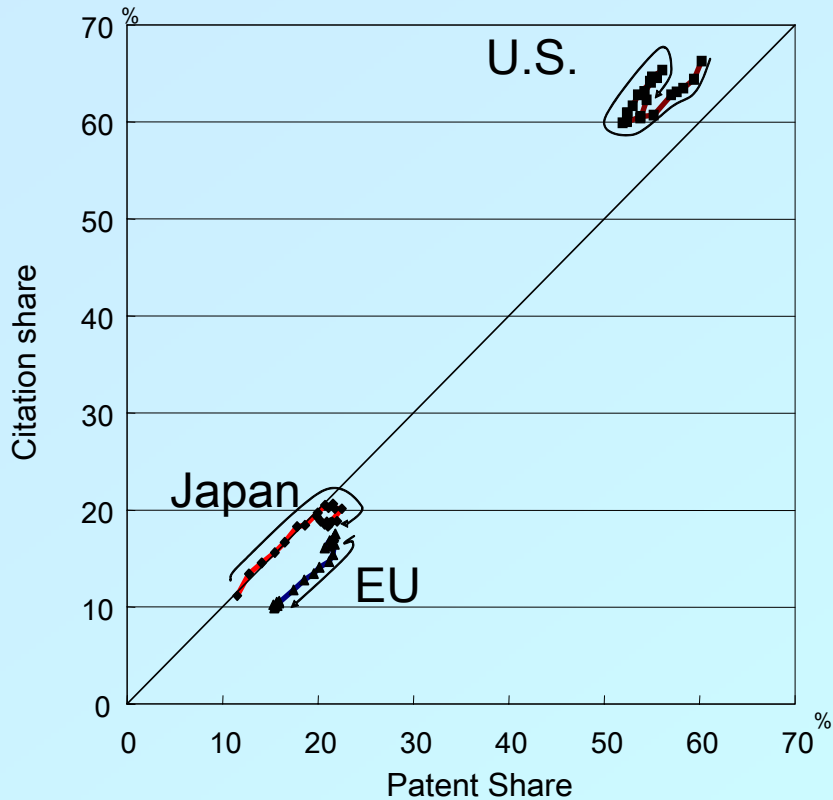
← High Japan' performance Low →

| | A (strong) | B (ordinary) | C (rather weak) | D (weak) |
|----------------------------------|---|---|--|--|
| High ↑ Growth in the world | <ul style="list-style-type: none"> ■ Materials Science & Engineering ■ Computer Science & Engineering ■ Cell & Developmental Biology ■ Oncology ■ AI, Robotics & Automatic Control | <ul style="list-style-type: none"> ■ Environment / Ecology | <ul style="list-style-type: none"> ■ Engineering Mathematics ■ Information Technology & Communications Systems | <ul style="list-style-type: none"> ■ Mechanical Engineering |
| | <ul style="list-style-type: none"> ■ Physics ■ Applied Physics / Condensed Matter / Materials Science ■ Medical Research, Organs & Systems ■ Molecular Biology & Genetics | <ul style="list-style-type: none"> ■ Organic Chemistry / Polymer Science | <ul style="list-style-type: none"> ■ Electrical & Electronics Engineering ■ Chemical Engineering ■ Biotechnology & Applied Microbiology | <ul style="list-style-type: none"> ■ Chemistry & Analysis ■ Food Science / Nutrition |
| | <ul style="list-style-type: none"> ■ Immunology ■ Pharmacology & Toxicology ■ Animal & Plant Sciences | <ul style="list-style-type: none"> ■ Mathematics | <ul style="list-style-type: none"> ■ Biochemistry & Biophysics ■ Medical Research, General Topics ■ Nuclear Engineering | <ul style="list-style-type: none"> ■ Chemistry ■ Agricultural Chemistry |
| Low ↓ | <ul style="list-style-type: none"> ■ Metallurgy | | <ul style="list-style-type: none"> ■ General & Internal Medicine ■ Agriculture / Agronomy ■ Physiology | <ul style="list-style-type: none"> ■ Experimental Biology |

Shares of U.S. Patents and their Citations among Japan, U.S. and EU (1980-2000)

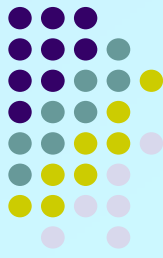


(Enlarged figure about Japan)



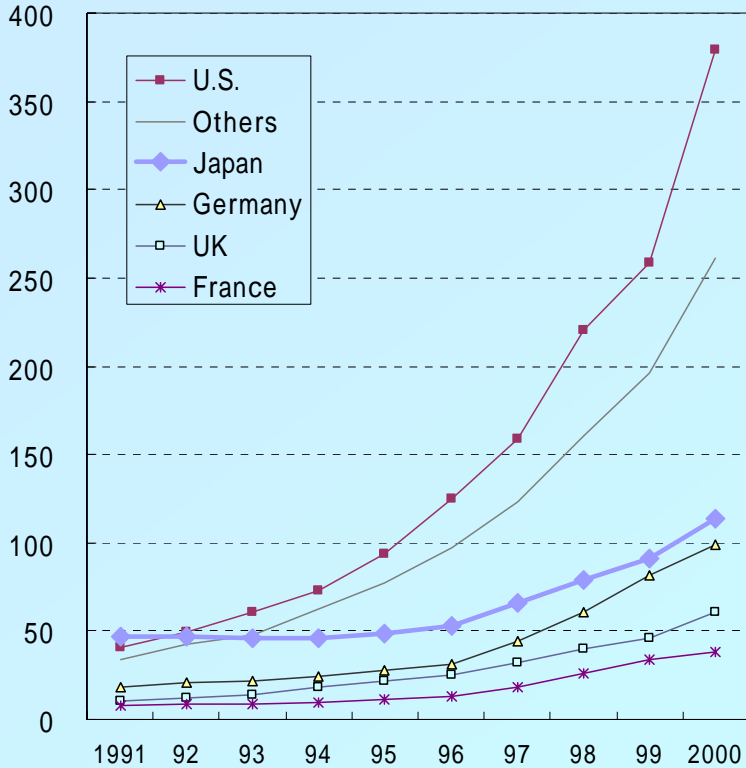
Data: CHI Research Inc. "International Technology Indicators 1980-2002"

Trends in Patent Applications in the World

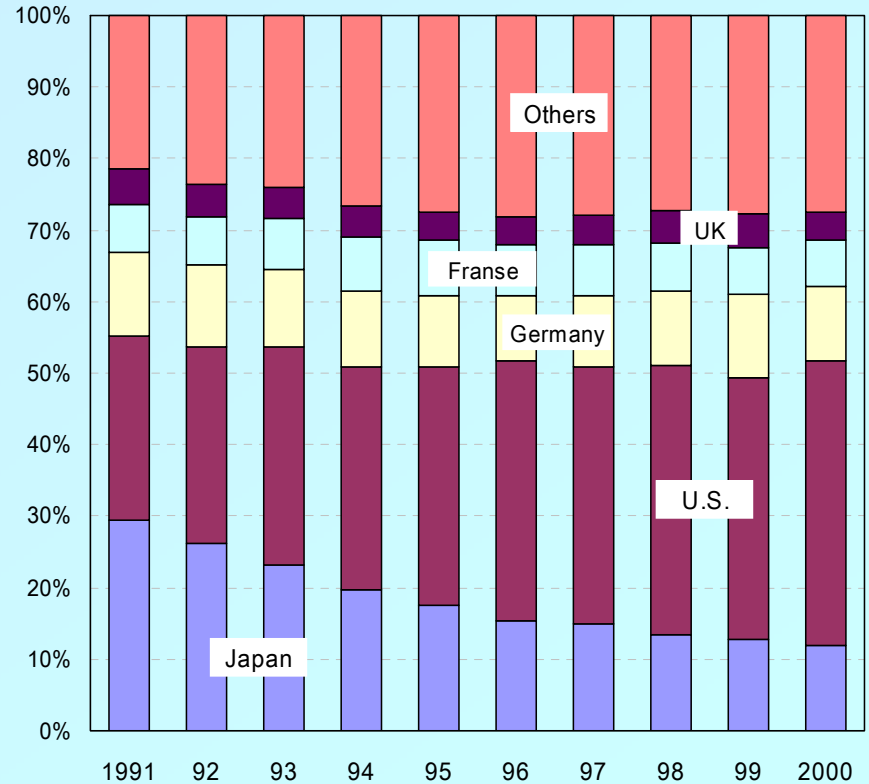


Number of patent applications

(10 thousand)

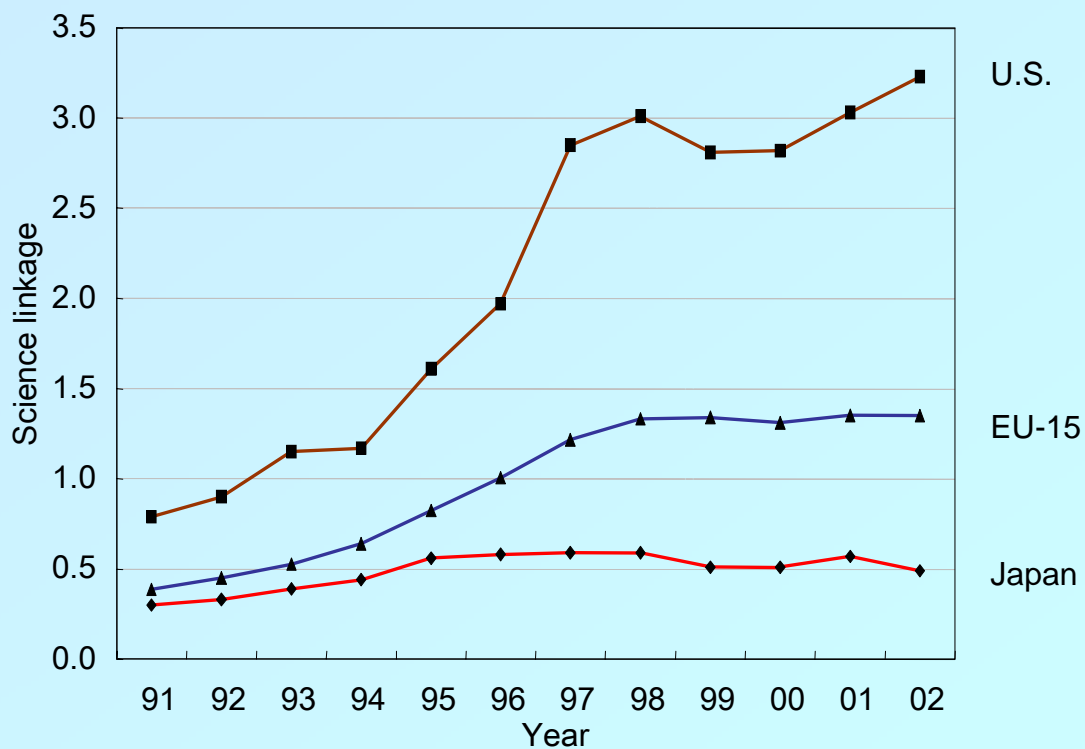
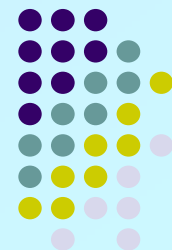


Patents application shares



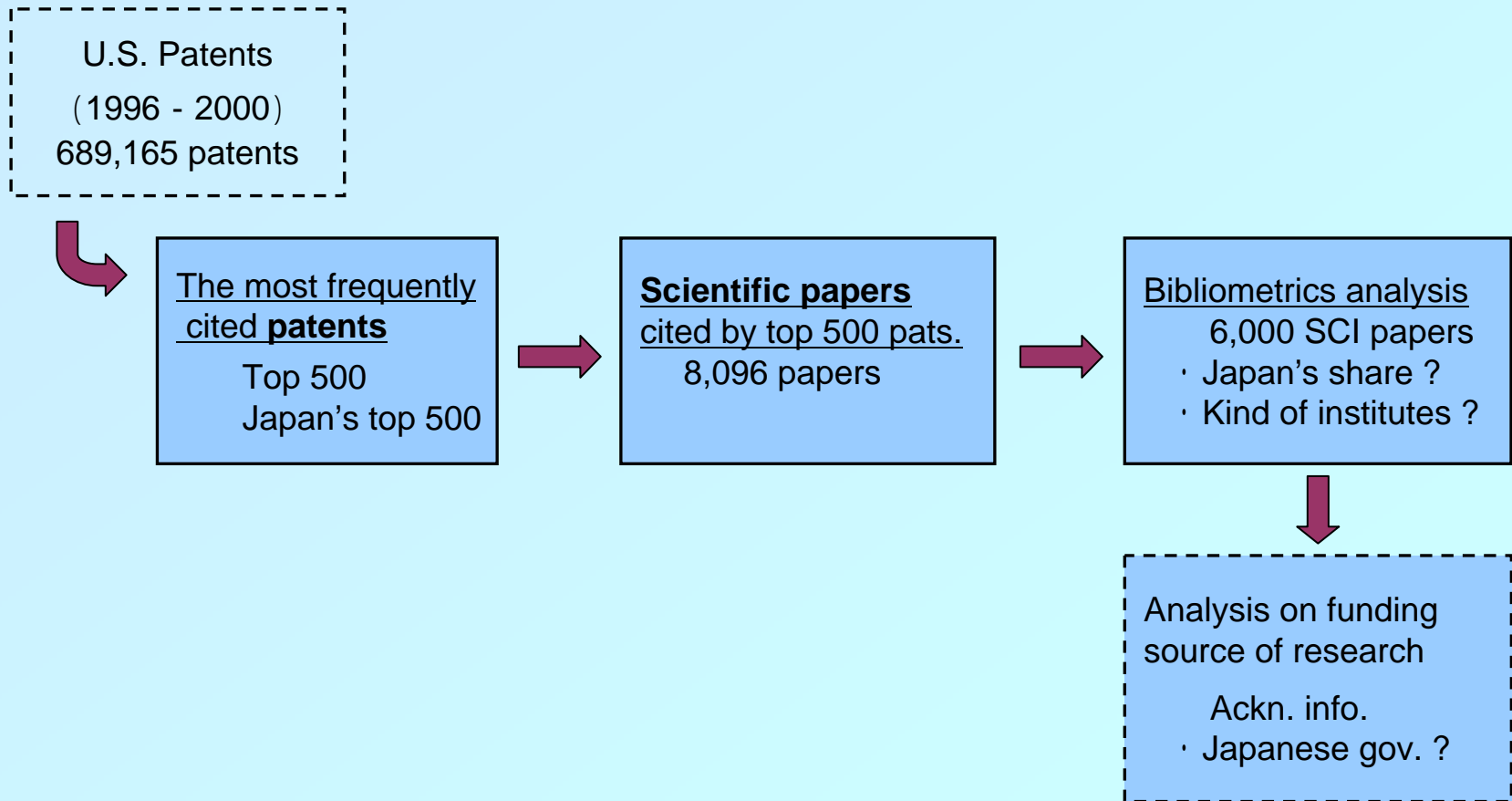
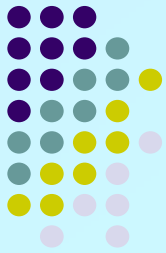
Data: WIPO, Industry Property Statistics

Science Linkage in U.S. patents



Data: CHI Research Inc. "International Technology Indicators 1980-2002"

Analysis on Linkage between U.S. Patents and Scientific Papers





Summary and implications

- Japan's productivity growth in science
 - End of “high-growth era” ?
 - S&T Basic Plans support productivity growth ?
- Quality of scientific research may be improved
 - Increase citation frequency
 - To find excellent institutions
- Can we analyze effects of policies ?
 - Fostering human resources, Industry-academia-government cooperation, Increase R&D funding, etc.