

# Understanding Technology Market: Quantitative Analysis of Licensing Activities in Japan

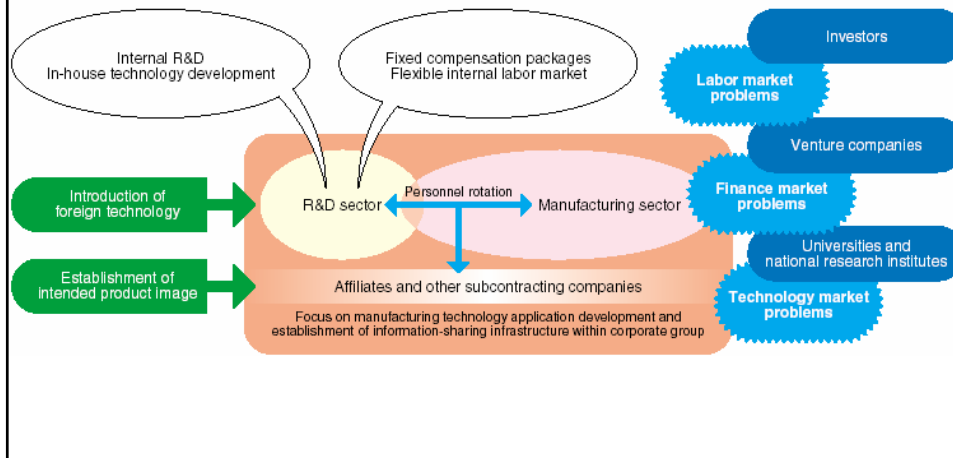
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## Outline of presentation

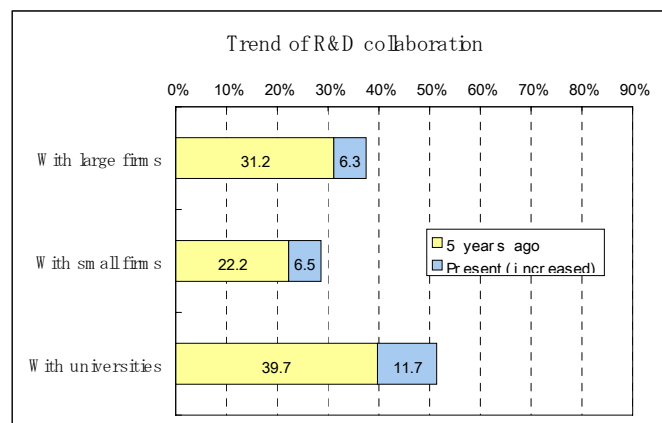
- Active use of external technology for Japanese firms: depart from in-house R&D innovation system?-RIETI's Survey on R&D external linkages
- Trend and structure of licensing market by Japanese official statistics
- Econometric analysis on the determinants of licensing

# Japan's national innovation system

## Compartment system by large company: Japan



## % of firms conducting R&D collaborations



RIETI's Survey on external R&D collaboration

## Possible Factors behind R&D collaboration

- Intense innovation competition: globalization and catching up of Korea, Taiwan and China
- Necessity of innovation speed in order to appropriate rents from R&D
- Importance of scientific knowledge for industrial innovation: particularly the case for bio-pharmaceuticals
- Institutional changes in science sector: PRIs and national university reforms

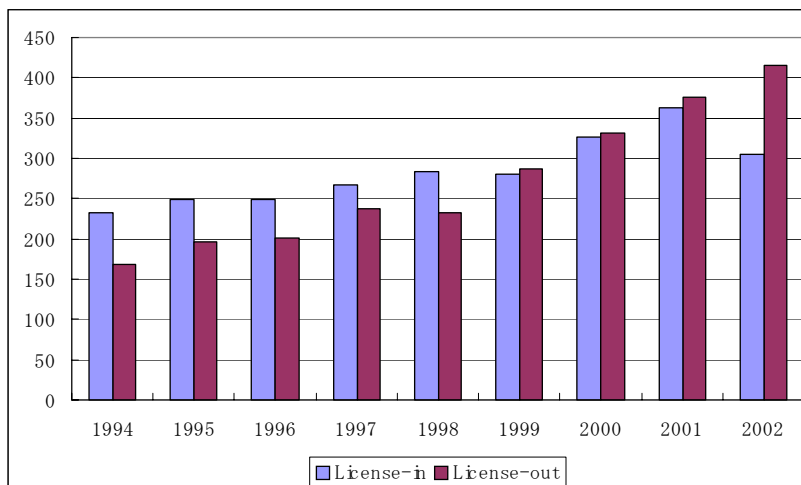
## Two data sources for licensing and IP activities

- Basic Survey of Business Structure and Activities (BSBSA): 1991, 1994-2002, METI's firm level census, covering wide survey items
- Survey on IP Related Activities (SIPA): 2001 and 2002, JPO's firm level survey on detail IP activities

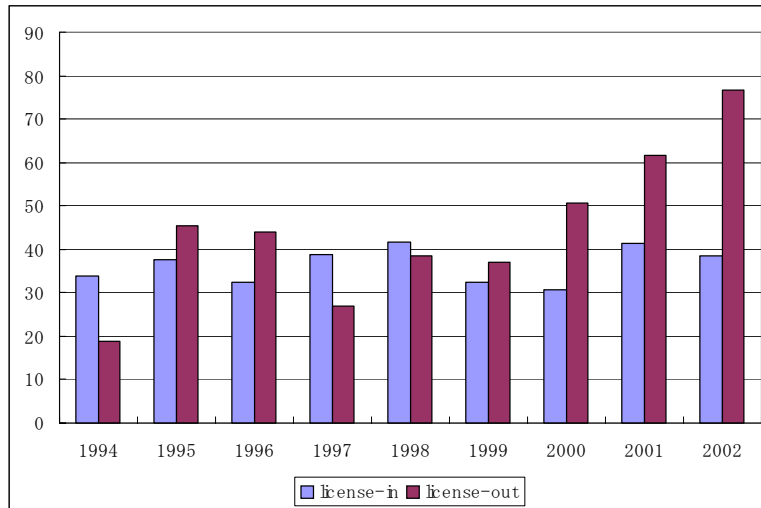
## METI's Basic Survey of Business Structure and Activities (BSBSA)

- Started in 1991. Annual data from 1994 to 2002 are available
- All firms with 50 employees and 30 mil yen capital, for manufacturing, wholesale/retail and selected business services (25,000 samples)
- Covering substantial R&D activities by JP firms: 8 trillion JPY R&D out of 12 trillion JPY
- Survey items
  - Various business related variables, such as production output and inputs, globalization, information network use, outsourcing as well as innovation activities
  - Innovation variables include R&D, patent and the value and the number of IPRs associated with licensing activities

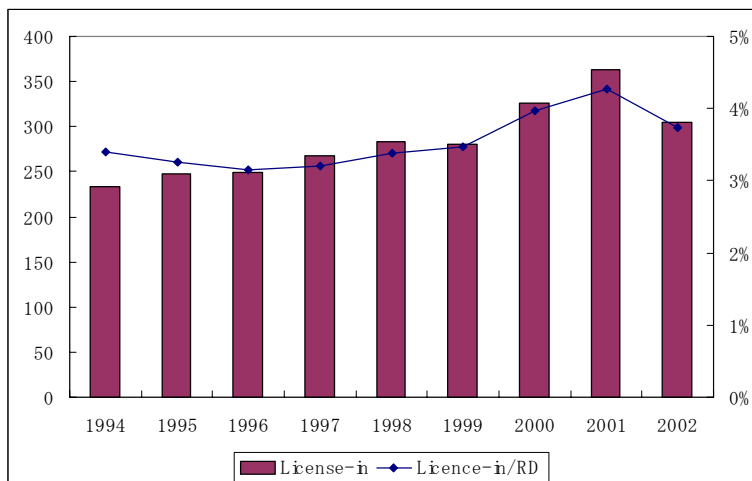
## Licensing Trend (billion JPY, BSBSA)



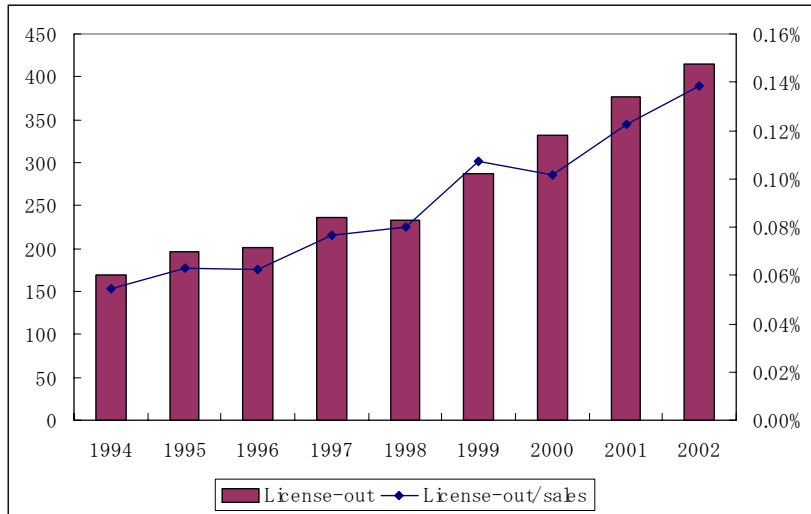
## License value per patent (million JPY, BSBSA)



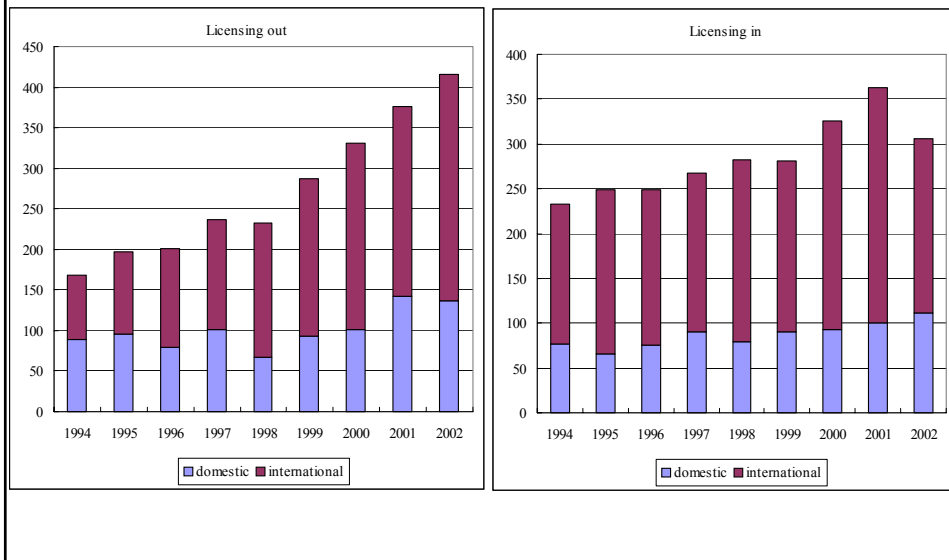
## Licensing intensity –License in-



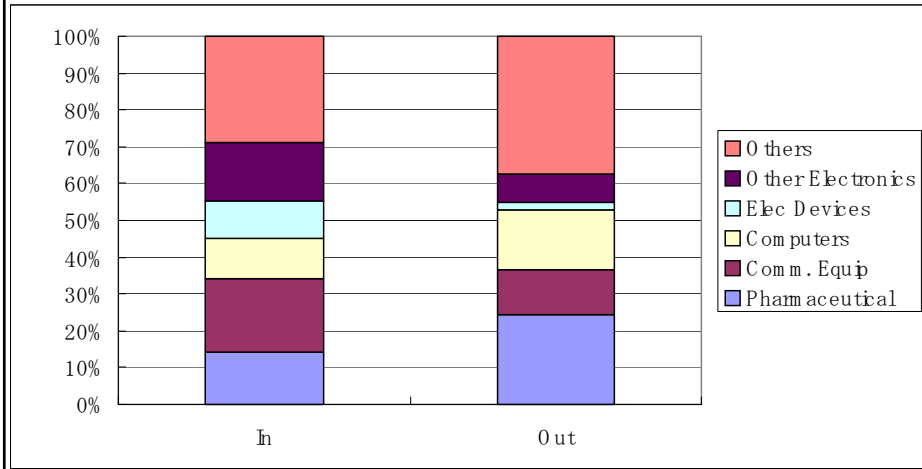
## Licensing intensity –License out-



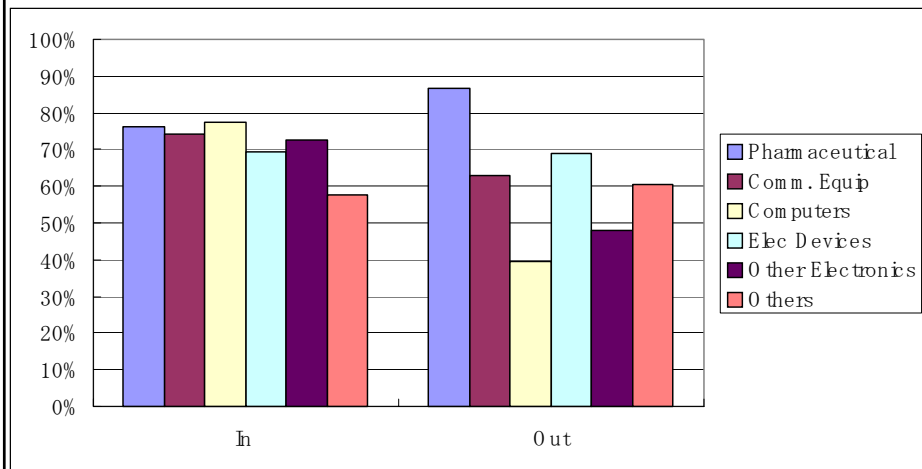
## Increasing international licensing



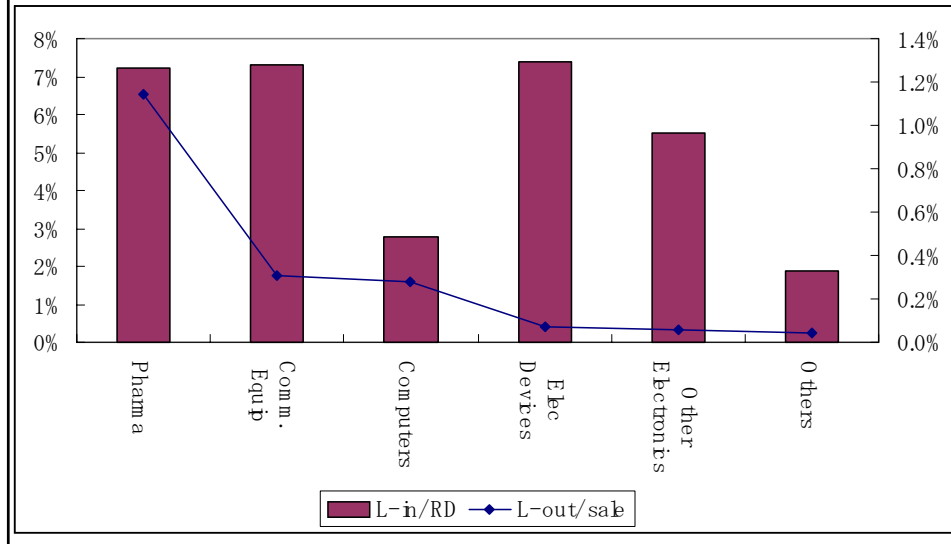
## Structure by industry (1994-2002)



## Share of international licensing 1994-2002



## Licensing Intensity



## Descriptive Regression BSBSA/Fixed Effect Model

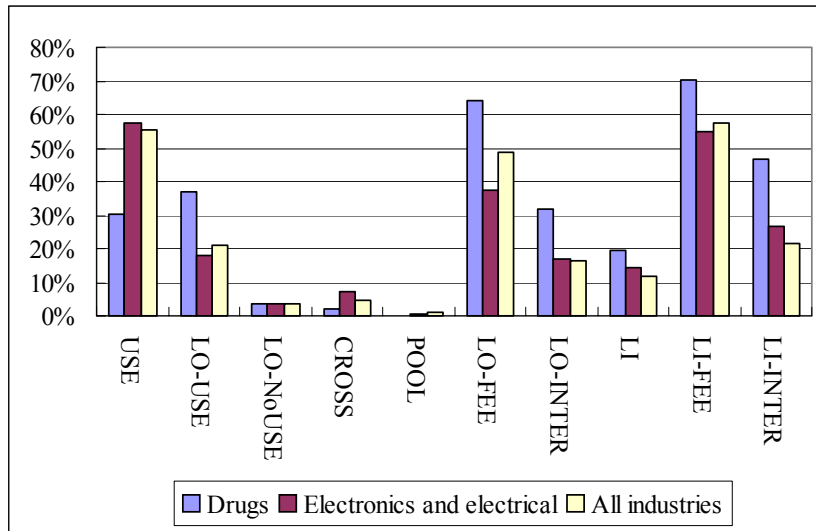
	lg(L-in)	lg(L-out)	% of int L-in	% of int L-out	per patent L-in	per patent L-out
lg(R&D)	0.035 (1.71)	<b>0.057</b> <b>(2.83)**</b>	-0.010 <b>(2.60)**</b>	-0.008 <b>(2.18)*</b>	<b>9.741</b> <b>(2.94)**</b>	-1.764 (0.38)
lg(R&D outsource)	<b>0.020</b> <b>(2.90)**</b>	-0.017 <b>(2.40)*</b>	0.005 <b>(3.69)**</b>	-0.003 <b>(2.41)*</b>	1.827 (1.61)	<b>5.838</b> <b>(4.49)**</b>
lg(# of patent)	0.134 <b>(6.27)**</b>	0.178 <b>(8.41)**</b>	0.009 <b>(2.16)*</b>	0.018 <b>(4.55)**</b>	10.473 <b>(2.93)**</b>	9.735 <b>(2.08)*</b>
lg(sale)	0.520 <b>(7.48)**</b>	0.100 (1.45)	0.024 (1.77)	-0.001 (0.09)	<b>74.890</b> <b>(6.59)**</b>	-31.283 <b>(2.09)*</b>
lg(employment)	-0.450 <b>(2.84)**</b>	-1.116 <b>(7.09)**</b>	0.049 (1.55)	-0.223 <b>(7.52)**</b>	-51.322 <b>(1.96)*</b>	-204.003 <b>(6.98)**</b>
lg(age)	-0.722 <b>(2.49)*</b>	-1.652 <b>(5.74)**</b>	0.030 (0.51)	-0.469 <b>(6.65)**</b>	16.774 (0.35)	-315.117 <b>(5.64)**</b>
lg(employment)*lg(age)	0.143 <b>(3.57)**</b>	0.272 <b>(6.83)**</b>	-0.004 (0.47)	0.064 <b>(3.49)**</b>	-1.581 (0.24)	51.081 <b>(6.72)**</b>
Constant	-1.873 <b>(1.47)</b>	6.402 <b>(5.08)**</b>	-0.315 (1.25)	1.822 <b>(7.67)**</b>	-534.156 <b>(2.52)*</b>	1607.141 <b>(6.42)**</b>
Observations	18718	18718	18718	18718	13595	10300
Number of id	2871	2871	2871	2871	2290	1524
R-squared	0.01	0.01	0.00	0.01	0.01	0.01

Absolute value of t statistics in parentheses

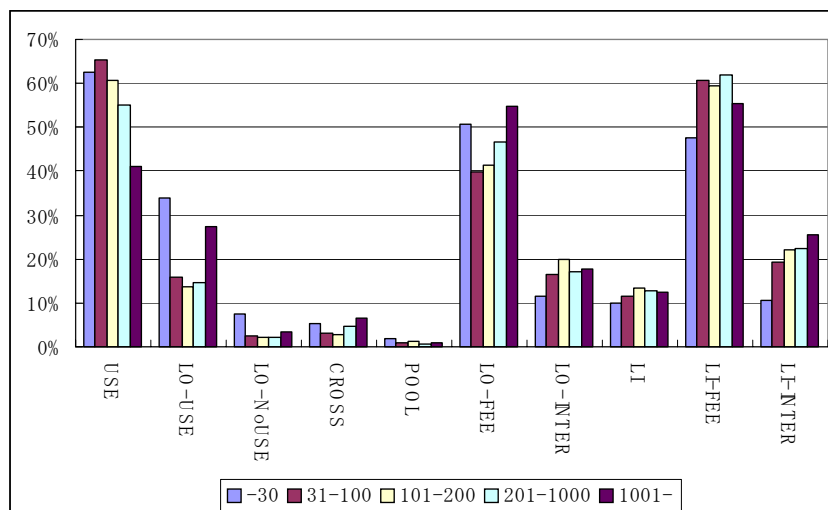
\* significant at 5%; \*\* significant at 1%



## Descriptive statistics: industry distribution



## Descriptive statistics: size distribution

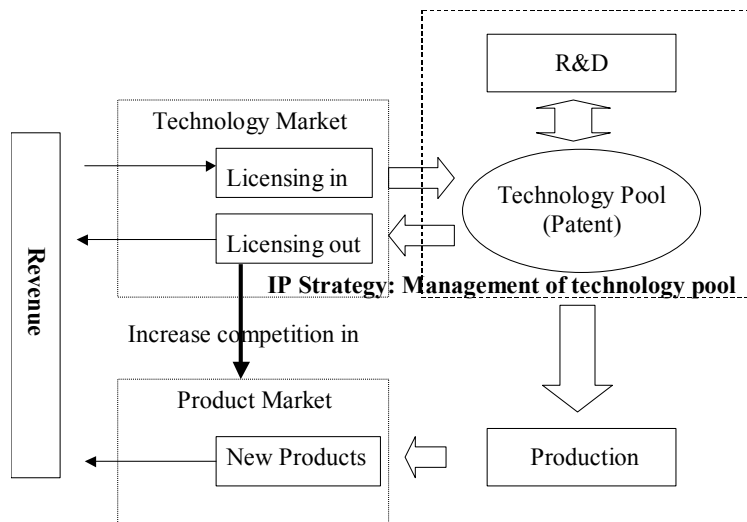


## Descriptive Regression JPO-SIPA

	USE	LO_USE	LO_NoUSE	CROSS	POOL	LO_FEE	LO_INTER	LI	LI_FEE	LI_INTER	LI/S	LO/S
age	0.121 (4.04)**	-0.194 (5.36)**	-0.053 (4.86)**	-0.017 (0.99)	0.008 (0.97)	-0.062 (0.93)	-0.057 (1.33)	-0.03 (1.13)	0.072 (0.71)	0.008 (0.11)	-0.009 (3.99)**	-0.092 (7.83)**
sale	0.005 (0.46)	-0.064 (4.97)**	-0.019 (4.92)**	0.002 (0.27)	0.002 (0.59)	-0.033 (1.49)	-0.017 (1.18)	0.022 (2.33)*	0.026 (0.72)	0.012 (0.43)		
saleage	-0.011 (3.53)**	0.015 (4.08)**	0.005 (4.03)**	0 (0.13)	-0.001 (1.06)	0.006 (0.94)	0.004 (1.04)	0 (0.11)	-0.004 (0.38)	-0.002 (0.30)		
ipemp	0 (0.01)	0.002 (4.58)**	0 (3.66)**	0 (2.62)**	0 (0.40)	-0.001 (2.78)**	0 (1.00)	0.001 (2.20)*	-0.001 (1.72)	0 (1.31)	0 (2.77)**	0 (0.69)
techhtl	0.103 (4.44)**	0.004 (0.14)	-0.001 (0.11)	0 (0.03)	-0.003 (0.49)	-0.119 (2.54)*	0.057 (1.87)	-0.02 (1.07)	-0.087 (1.79)	-0.019 (0.55)	0.003 (1.60)	-0.001 (0.27)
patsize		0.04 (8.42)**	0.00 (-1.23)	0.01 (3.42)**	0.00 (-0.02)	0.04 (3.66)**	0.02 (2.62)**	0.02 (5.27)**	0.04 (3.36)**	0.02 (-1.84)	0.00 (-0.94)	0.00 (-1.03)
emp											-0.005 (3.89)**	-0.055 (7.93)**
empage											0.001 (3.65)**	0.013 (7.61)**
Constant	0.816 (2.67)**	0.715 (2.28)*	0.242 (2.24)*	0.02 (0.13)	-0.014 (0.20)	1.237 (2.61)**	0.162 (0.53)	0.134 (0.58)	0 (.)	0 (.)	0.028 (2.03)*	0 (.)
Observations	4276	3298	4276	3408	3368	1575	1573	3408	1421	1419	2851	2851
Number of id	3191	2514	3191	2594	2567	1181	1180	2594	1062	1061	2299	2299

Absolute value of z statistics in parentheses  
\* significant at 5%; \*\* significant at 1%

## IP strategy analysis: framework



## Conclusion

- Growing trend of R&D collaboration and licensing (particularly for licensing-out)
- International licensing contributes to this trend
- Growing per patent licensing value for international licensing
- These trends can be observed particularly in pharmaceutical industry (globalization of J. pharma)
- Increasing license-in for IT firms, reflecting globalization of IT innovation
- Smaller firms use more their patent pool
- Smaller and younger firms use licensing more