

# University Patenting in Korea: Trends, Characteristics and Implications

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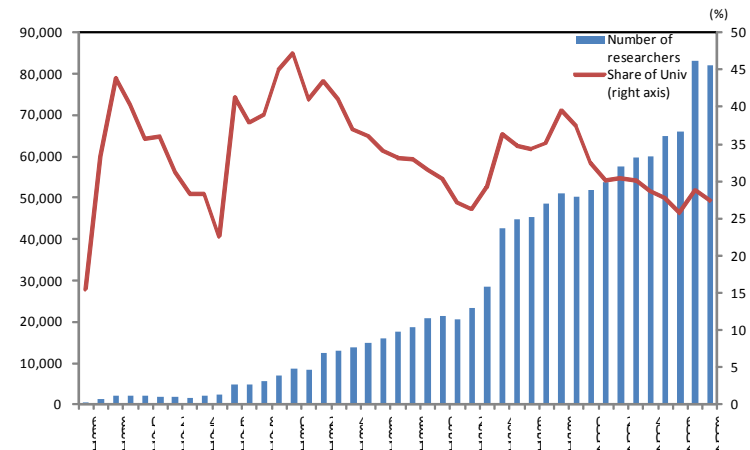
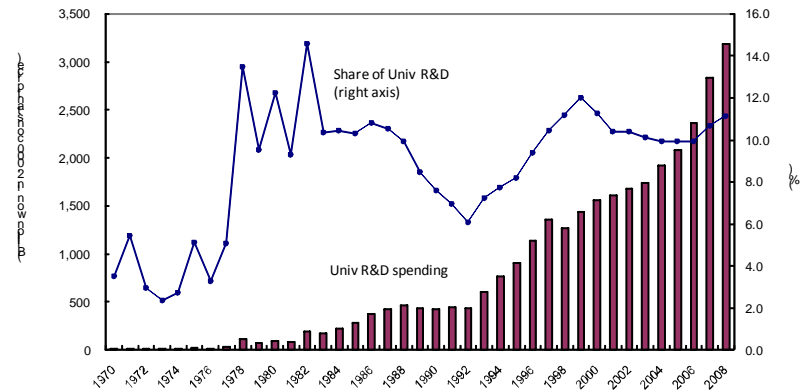
Korea Development Institute

# Background

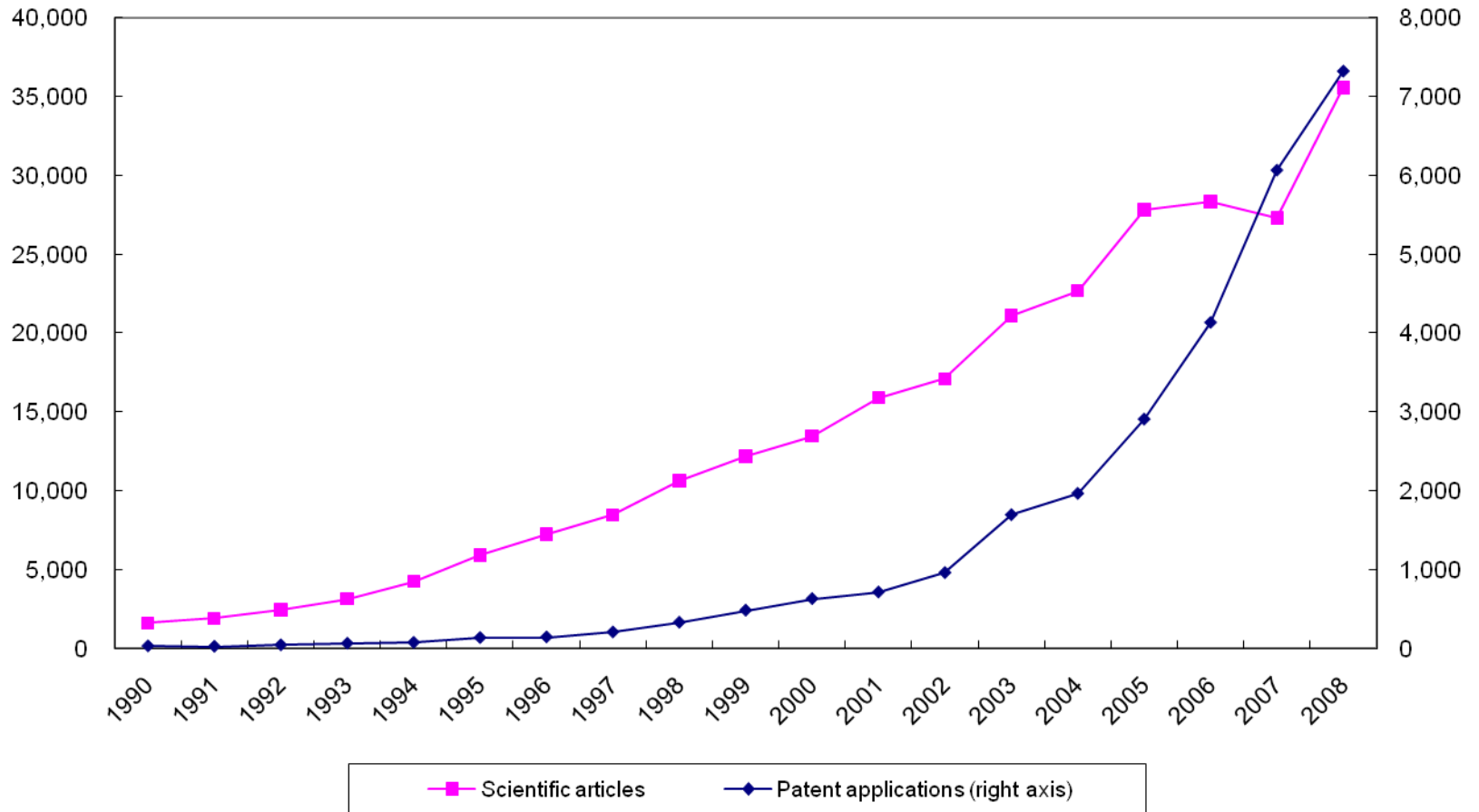
- To advance for Korea to high income econ, new development strategies are required
  - From imitation to innovation, from catch-up to creative
- Universities are expected to play a new role
  - Education, research, **and** direct contribution to wealth creation, economic growth or regional development
- Despite rapid growth in UR, no clear SP
  - The legacy of ‘developmental state’, tech policy
- 2 year project on framework of SP
  - Study on university patenting activities can offer a good indicator/guidance to policy design

# Phenomenal growth of university research

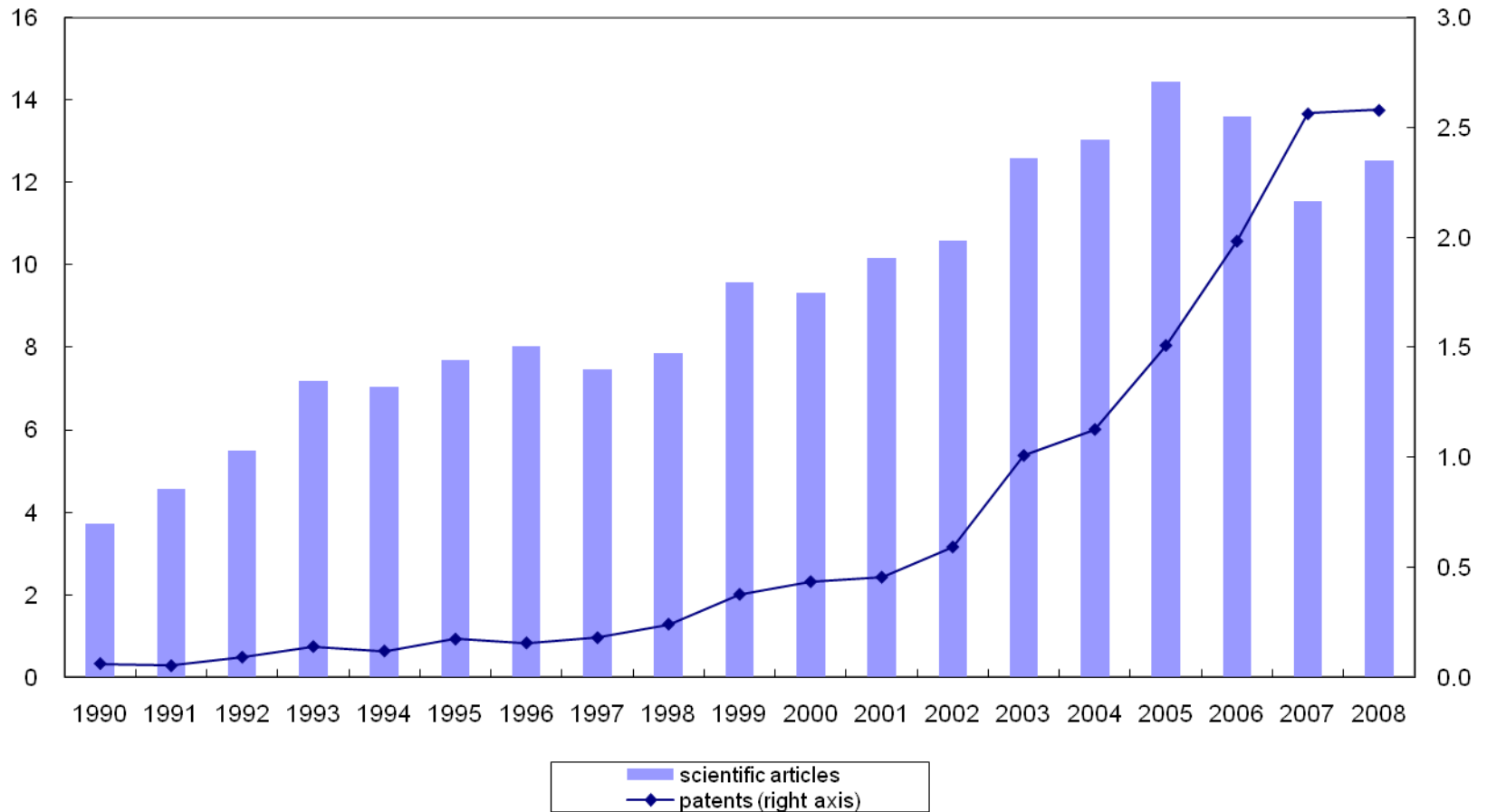
- Univ R&D spending in constant terms has tripled between 1995 and 2008
  - The share has increased from 8% to 11%
- The number of university researchers has also rapidly increased: almost tripled 1995 - 2008



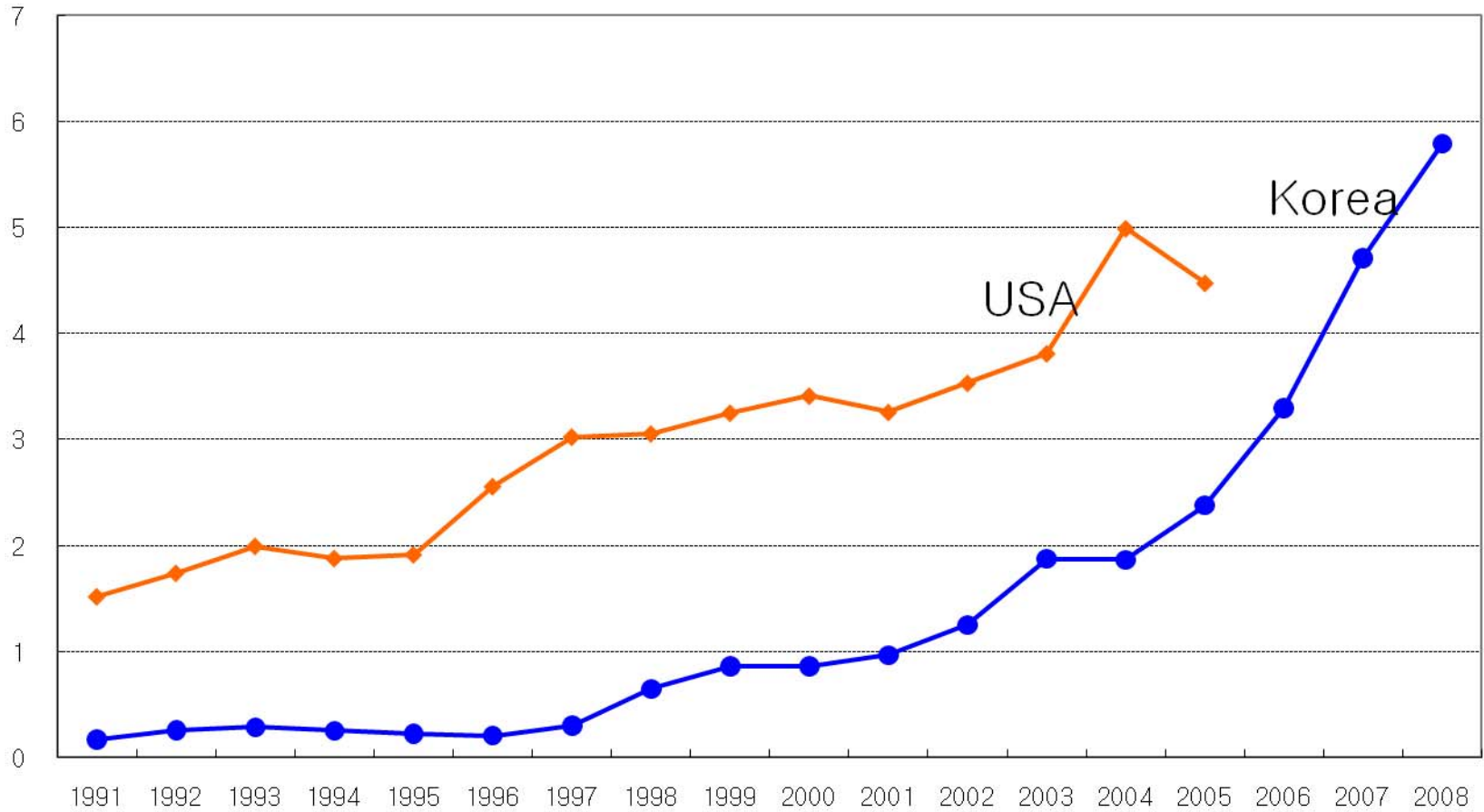
# University research outputs



# Output per spending (in cont. billion won)



# Share of University Patents in US and Korea



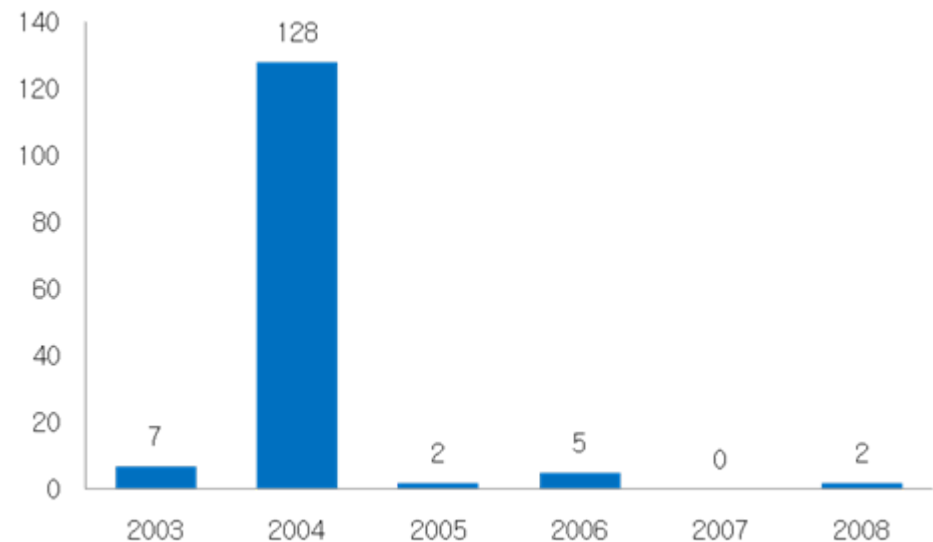
# Government initiatives

- **Technology Transfer Promotion Act** (2000) allowed the reversion of ownership of NRDP outputs to public research institutes (universities) and private enterprises
- **Industry-Academia Coop Promotion Act** (2003) encouraged the creation of IAC Office, and TLO, as a university body
- Sharp increases in R&D funding to universities through contract research

# Universities respond proactively

- As universities realized importance of research, strengthened R&D management
- Industry-Academia Coop Office was a model as such, and encouraged by government

Creation of IAC Office



Source: MEST & KRF, 2008 White Paper on Industry Academia Cooperation

# Strong incentives for patenting

## Reward Scale relative to SCI Paper of one author

	2006		2007		2008	
	number of universities	average percentage scale	number of universities	average percentage scale	number of universities	average percentage scale
domestic patent application	29	9.8	41	14.0	46	28.0
domestic patent grant	97	17.4	116	22.0	125	43.5
foreign patent application	29	10.4	41	17.5	15	45.0
foreign patent grant	99	15.9	114	20.8	124	77.5
number of technology transfer	10	5.2	19	12.6	46	39.5
fees from technology transfer	22	14.8	32	12.1	41	51.6
number of technical consulting	19	4.5	28	7.9	41	17.2
fees from technical consulting	-	-	14	11.9	27	45.8
number of IAC project	30	19.6	28	14.1	61	32.1
funds of IAC project	-	-	48	21.3	72	38.9
creation of start-up company	13	3.5	16	8.1	21	29.5

## Distribution of Scales

	average	minimum	maximum	25percentile	50percentile	75percentile
domestic patent application	28.0	3	120	10	20	33
domestic patent grant	43.5	1	133	27	40	50
foreign patent application	45.0	6	200	16	25	50
foreign patent grant	77.5	1	250	50	70	100

Source: MEST & KRF, 2008 White Paper  
on Industry Academia Cooperation

# Some observations

- Universities began patenting only recently; except specialized engineering schools
- National universities, except SNU, are regional centers of excellence
- Private universities are performing well, they are mostly located at capital region

# Patent application by university

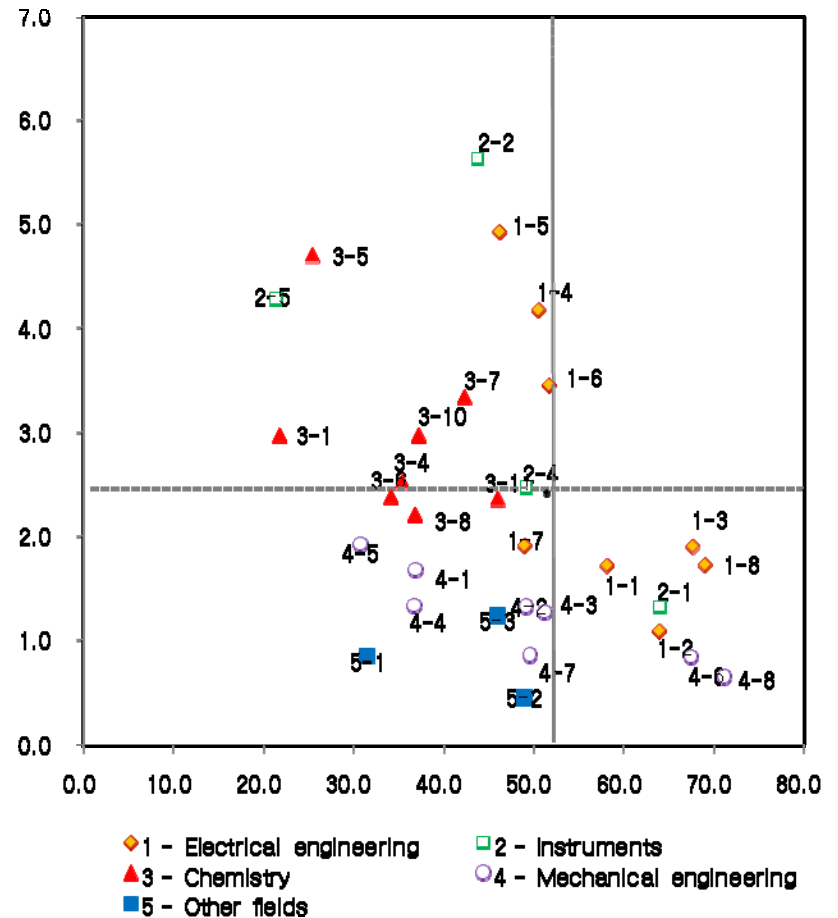
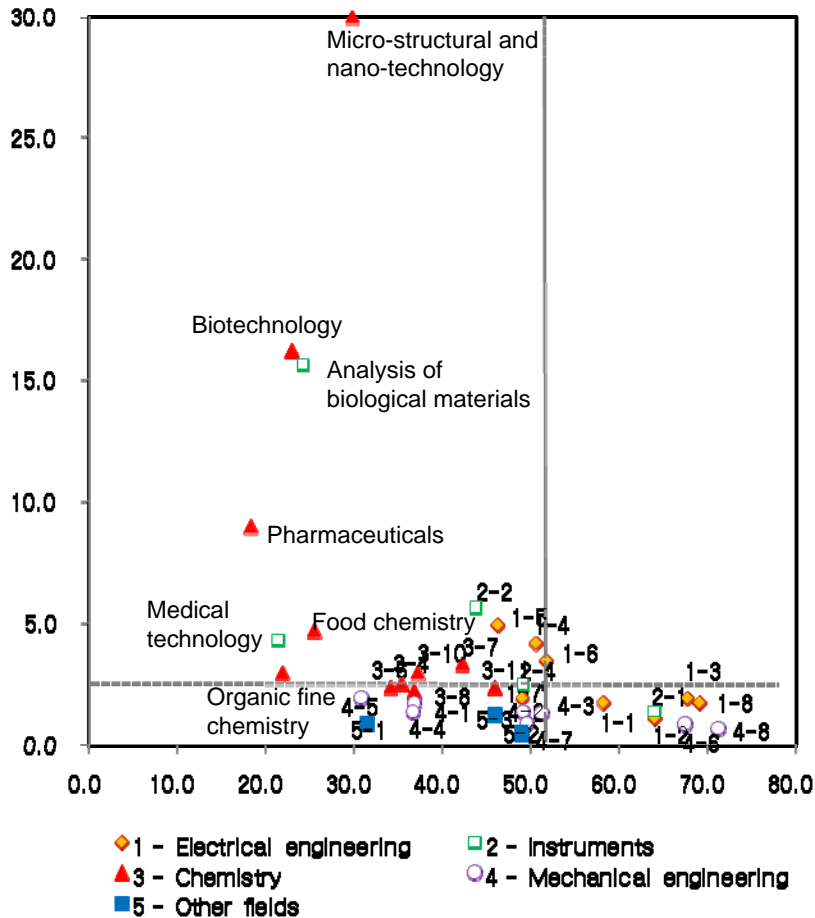
		2000	2001	2002	2003	2004	2005	2006	2007	2008	Sum
1	KAIST	196	190	182	196	248	299	347	497	644	2,799
2	SNU	22	37	142	177	234	292	385	519	669	2,477
3	Korea	37	37	30	58	82	184	276	438	442	1,584
4	Yonsei	27	35	52	108	101	133	274	375	475	1,580
5	Hanyang	21	38	60	104	83	166	267	364	405	1,508
6	POSTECH	91	108	124	101	113	107	155	165	251	1,215
7	Inha	38	43	47	92	96	130	171	255	294	1,166
8	SKK	1	2	5	8	20	124	109	279	326	874
9	GIST	82	63	47	73	73	73	103	156	173	843
10	Kyunghee	3	17	17	18	61	48	132	185	253	734
11	KNU	1	9	27	34	54	81	122	183	176	687
12	CNU	-	2	3	22	49	50	113	139	207	585
13	Kunkuk	-	3	2	4	24	71	110	155	203	572
14	PNU	-	4	10	16	59	57	101	128	186	561
15	Choongnam NU	-	19	23	39	35	65	65	90	128	464
16	Chonbuk NU	-	4	5	12	18	50	114	109	137	449
17	Choongang	-	2	3	7	16	54	91	104	142	419
18	Kangwon NU	-	1	9	15	23	34	70	133	129	414
19	Kyungsang NU	4	3	18	33	34	47	69	110	92	410
20	Choongbuk NU	-	1	6	9	18	25	74	117	149	399
21	Ajou	-	-	7	9	20	31	28	99	103	297
22	Ewha W	-	2	3	9	16	36	48	74	79	267
23	Youngnam	-	2	3	2	6	39	59	76	72	259
24	Bukyung	-	3	11	13	20	40	52	54	62	255
25	Chosun	-	-	1	-	2	19	46	83	76	227

# Scientific papers by university

		2000	2001	2002	2003	2004	2005	2006	2007	2008	Sum
1	SNU	2,004	2,232	2,486	2,715	2,970	3,238	3,512	3,824	4,238	27,219
2	Yonsei	895	1,047	1,213	1,260	1,487	1,646	1,830	2,019	2,565	13,962
3	KAIST	1,191	1,168	1,183	1,175	1,205	1,289	1,359	1,351	1,507	11,428
4	Korea	546	703	795	861	950	1,293	1,512	1,768	2,056	10,484
5	SKK	517	674	770	816	902	1,130	1,299	1,509	1,809	9,426
6	Hanyang	507	657	767	881	879	971	1,120	1,240	1,503	8,525
7	POSTECH	556	668	723	817	806	761	849	878	1,130	7,188
8	KNU	430	474	630	674	703	793	896	1,027	1,151	6,778
9	PNU	392	448	474	564	699	687	787	918	1,146	6,115
10	CNU	362	419	442	497	629	703	767	830	963	5,612
11	Choongnam NU	275	328	358	483	537	607	672	768	867	4,895
12	Inha	361	331	394	474	501	559	586	701	830	4,737
13	Kyunghee	235	305	351	426	540	536	590	713	909	4,605
14	Ulsan	265	294	363	413	422	491	564	748	839	4,399
15	Chonbuk NU	199	296	341	383	485	490	551	596	832	4,173
16	Ewha W	210	258	299	386	434	414	486	536	588	3,611
17	Catholic	209	258	281	302	380	395	482	576	694	3,577
18	Kunkuk	132	181	192	232	318	398	532	645	846	3,476
19	GIST	187	290	338	338	349	387	421	431	503	3,244
20	Choongbuk NU	191	225	255	288	364	434	388	488	591	3,224
21	Kyungsang NU	156	206	265	267	291	353	424	563	616	3,141
22	Ajou	225	229	272	279	309	368	395	431	577	3,085
23	Kangwon NU	173	196	225	254	270	322	363	454	555	2,812
24	Choongang	159	153	183	205	285	310	284	398	505	2,482
25	Youngnam	161	160	177	211	255	247	290	354	469	2,324



NT, BT and pharmaceuticals are where UP is active;  
 engineering technologies are where business leads



# The quality of Korean patent

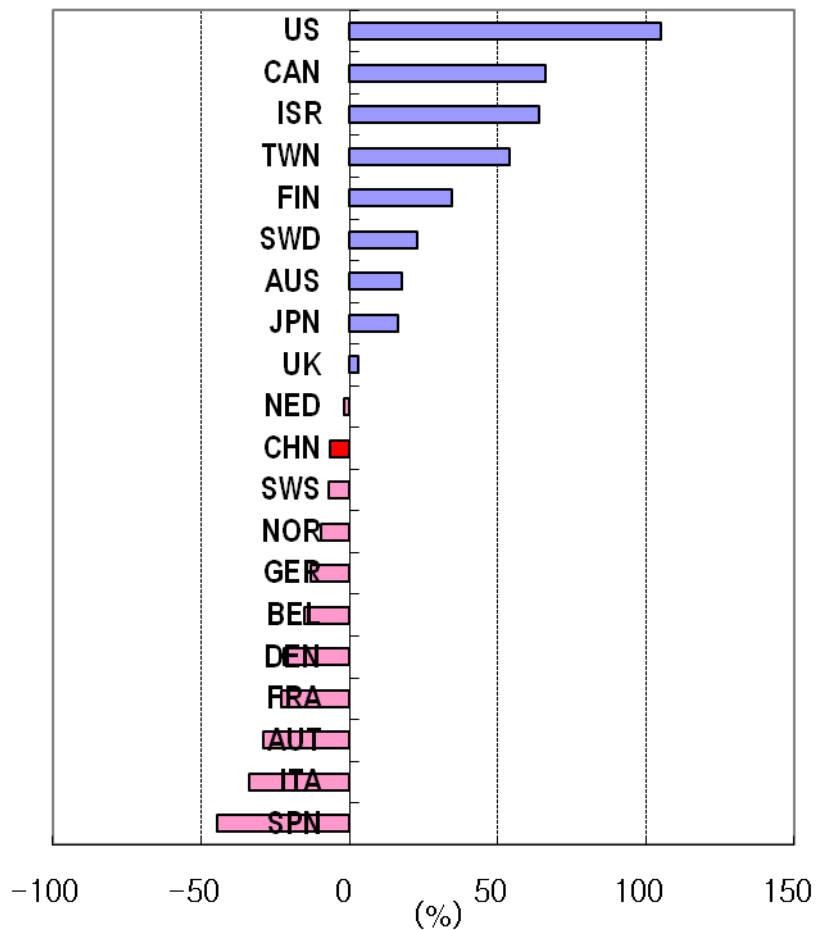
## US Patent by Country of Origin and Frequency of Forward Citation

- Forward citation data from **NBER DB** used as a proxy for patent quality
- Korea ranked 6<sup>th</sup> in patents granted by USPTO until 2006
- Korea's forward citation, 8.4, is below the average of all countries 11.5 or 9.3 excluding US
- Korean universities' forward citation, 5.7, is also below the average of all countries, 12.7 or 7.3 excluding US

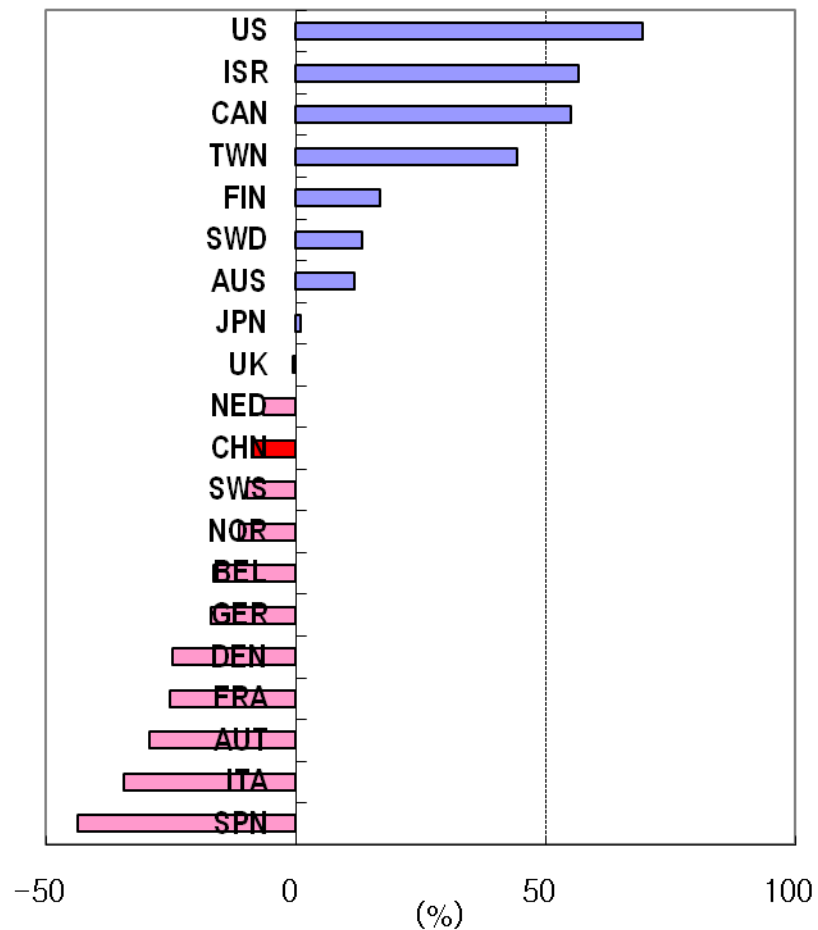
	Number of Patent			Frequency of Forward Citation			
				(including self-citation)		(excluding self-citation)	
	Total	Univ	Share of Univ (%)	Total	Univ	Total	Univ
USA	1,479,323	50,691	3.4	14.2	13.8	12.8	13.8
Japan	650,307	896	0.1	10.0	4.7	9.2	4.7
Germany	196,880	203	0.1	7.2	5.2	7.1	5.2
France	78,028	262	0.3	7.5	6.1	7.4	6.1
UK	56,066	1,331	2.4	9.0	7.2	8.9	7.2
Korea	42,823	650	1.5	8.4	5.7	8.4	5.7
Canada	40,963	2,118	5.2	11.8	9.7	11.5	9.7
Taiwan	35,984	368	1	9.8	1.5	9.4	1.5
Swiss	35,381	207	0.6	7.3	7.4	7.2	7.4
Italy	28,313	161	0.6	6.5	4.0	6.4	4.0
Sweden	23,941	13	0.1	9.8	1.7	9.4	1.7
Netherlands	22,559	240	1.1	7.4	6.2	7.2	6.2
Finland	11,807	21	0.2	10.3	7.4	9.4	7.4
Australia	11,011	696	6.3	8.3	7.3	8.2	7.3
Israel	8,591	827	9.6	11.8	8.2	11.7	8.1
Belgium	8,145	194	2.4	6.9	4.1	6.9	4.1
Danmark	6,493	27	0.4	7.0	9.1	6.9	9.1
Austria	6,402	6	0.1	5.9	5.3	5.8	5.3
Norway	3,328	1	0	7.3	0.0	7.3	0.0
Spain	2,543	83	3.3	5.2	9.8	5.2	9.8
China	1,847	329	17.8	4.5	5.6	4.5	5.6
All countries	3,290,388	61,285	1.9	11.5	12.7	10.7	12.7
(Except USA)	1,811,065	10,595	0.6	9.3	7.3	8.9	7.3

# The Relative Importance of Korean Patents

(base country = Korea, control variable = tech fields and years)



Including self-citation



Excluding self-citation

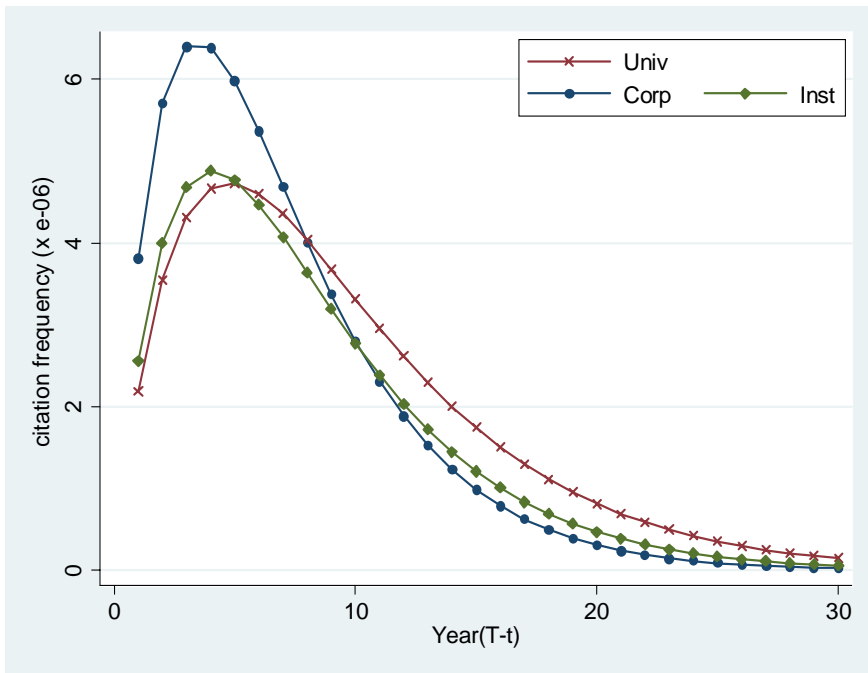
# Basicness of university patent?

- Measures proposed by Trajtenberg, Henderson and Jaffe (1997)
- Except science-linkage and self-citation, basicness of university research hypothesis is not statistically strongly supported
- Regression results are not shown here

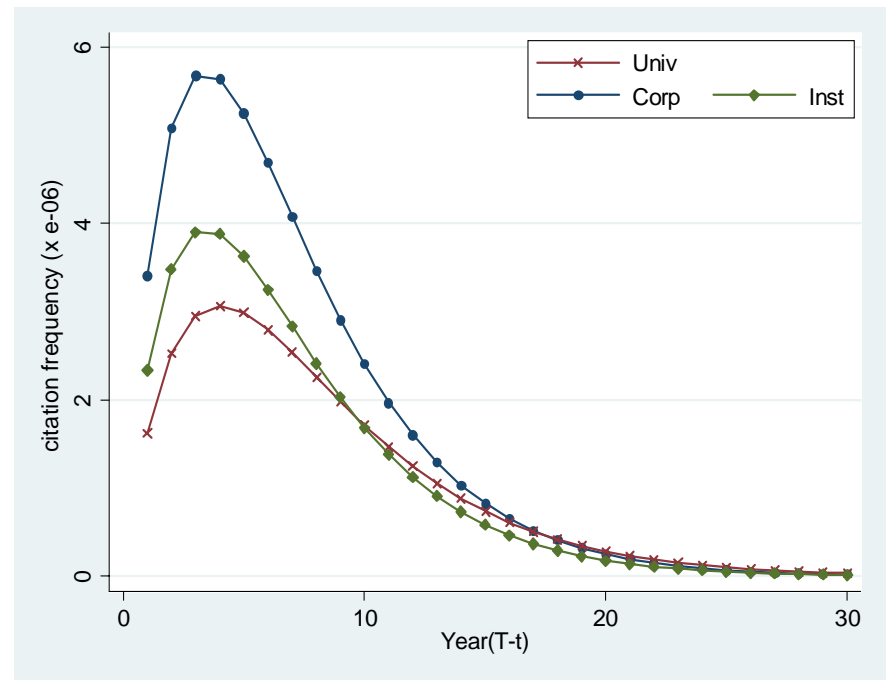
	Generality		
	Mean	SD	Median
Business	0.261	0.371	0
University	0.237	0.369	0
Res Inst	0.258	0.372	0
Total	0.261	0.371	0
	Originality		
	Mean	SD	Median
Business	0.415	0.393	0.476
University	0.453	0.401	0.528
Res Inst	0.432	0.392	0.5
Total	0.417	0.393	0.5

# Estimating citation function a la Caballero & Jaffe (1993)

## Forward citation



## Backward citation



# Some findings

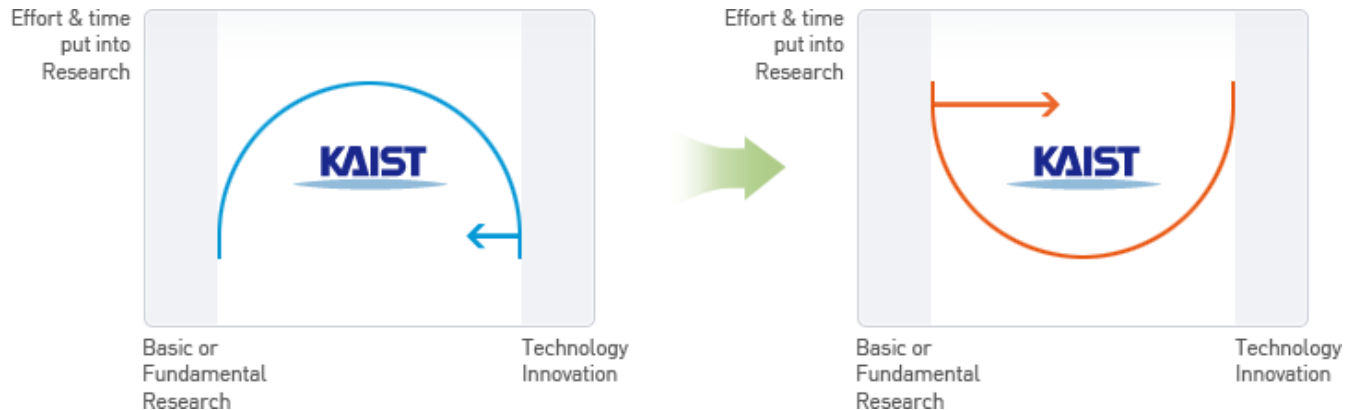
(with caveats)

- Korea's university patents do not show basicness as in the US case of T-H-J
- Forward citation: The quality of university patents are not above business enterprises  
cf: Jaffe·Trajtenberg(1996), Bacchiocchi·Montobbio(2009)
- Backward citation: University patents not as active in knowledge spillover as business
- All these are supportive of the criticism that universities try to produce more patents only for the “numbers”

# Policy issues

- How to upgrade research quality
  - A key issue for transition from imitation to innovation
  - Quality vs. quantity: Two ends of research spectrum
- Despite phenomenal support for UR, no clear evidence on direct effect
- Concerns over commercialization of science
  - Government funding: research grant < contract research
  - What balance between S and T in UR?
- What role for basic/academic research
  - UR has been “left out”; but its importance is increasing
  - Relationship with business and GRIs
  - Role in regional development? Creating new industry?

# Two ends of research spectrum



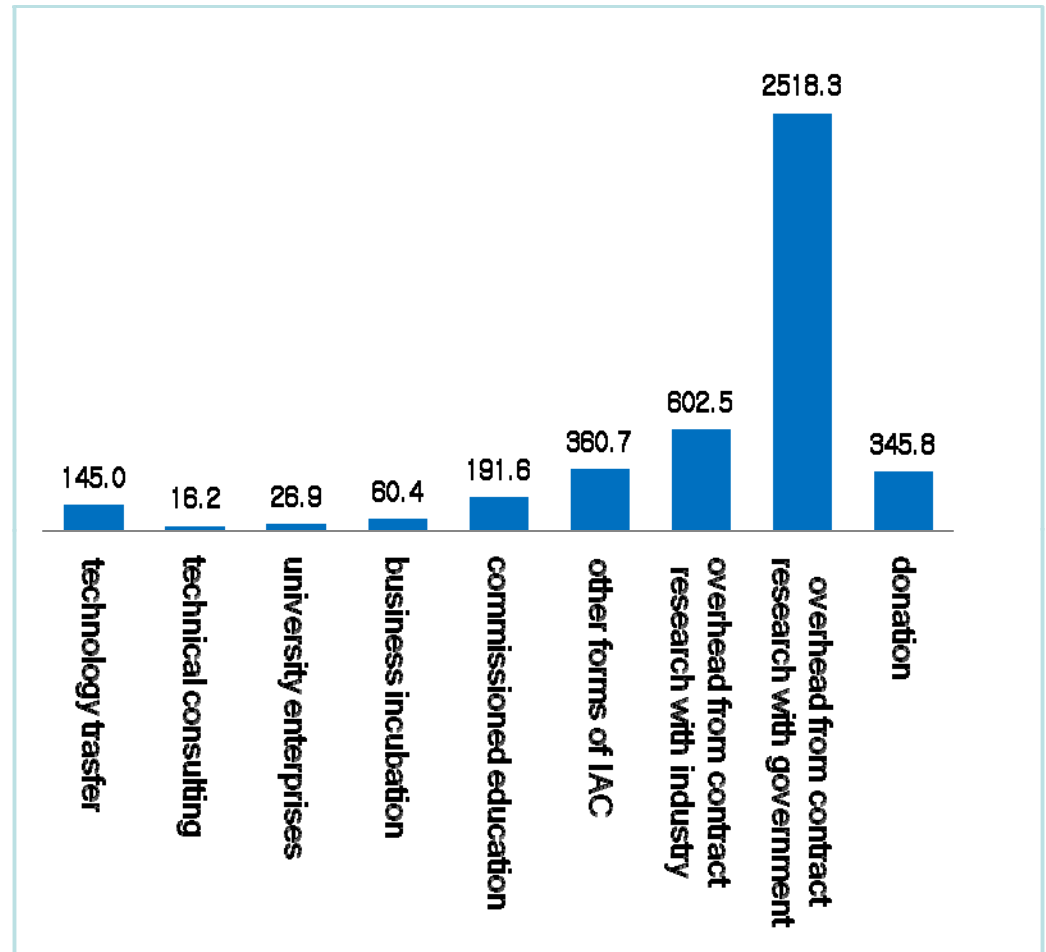
Source: KAIST homepage

“If counting only the number of papers or patents, basic research and technology innovation, that accompanies high risk and necessitates high input, tends to be less favored. But outputs in the middle have less impact or citation. Research in KAIST should move into those areas of high risk and high impact.” (Dr. Suh NamPyo, President of KAIST, 2008)

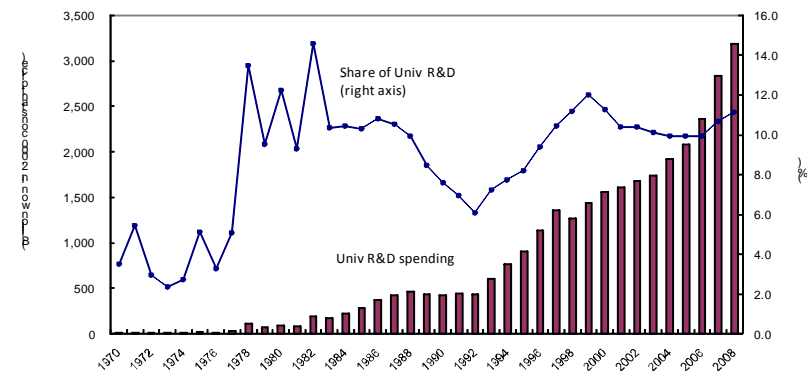
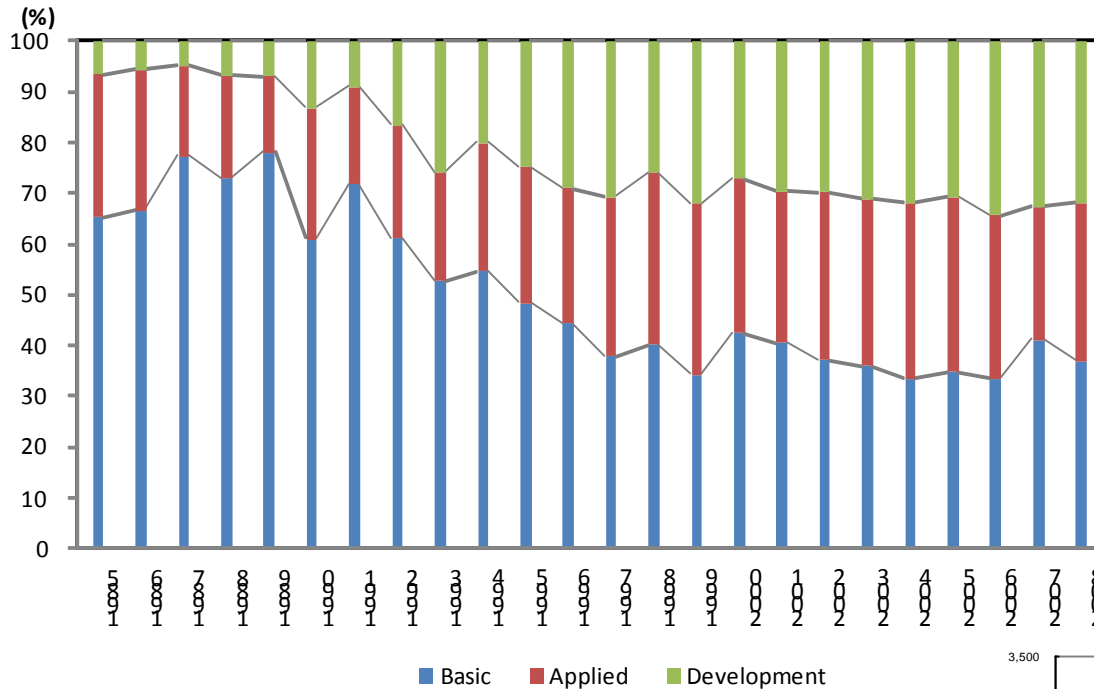
# Income sources of IAC Office

(2008, average in million won)

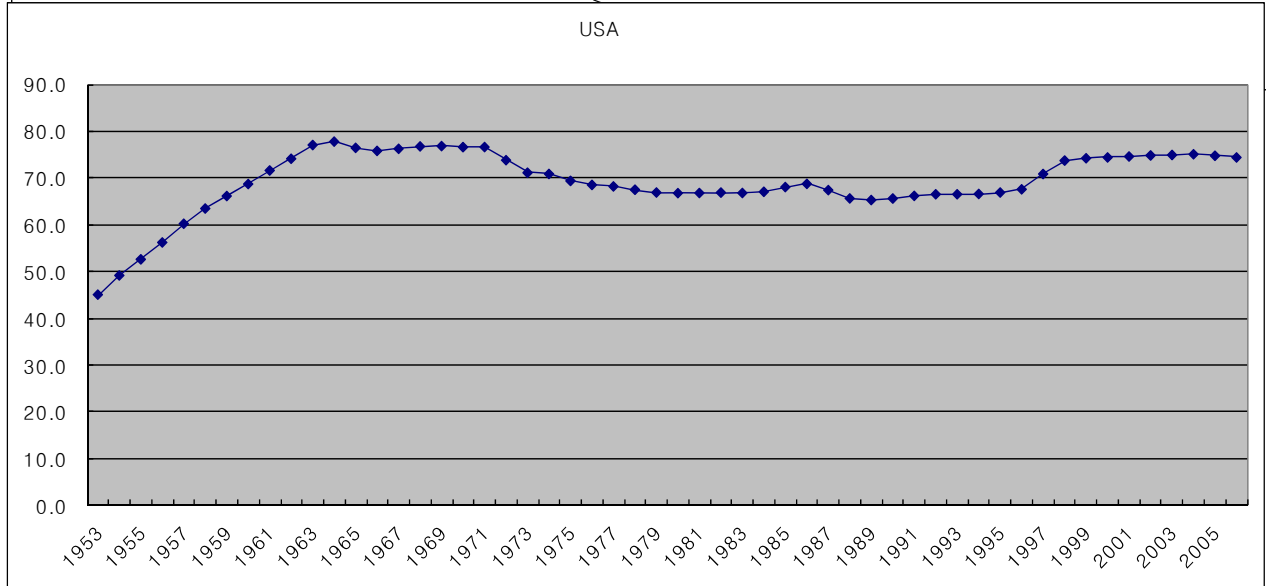
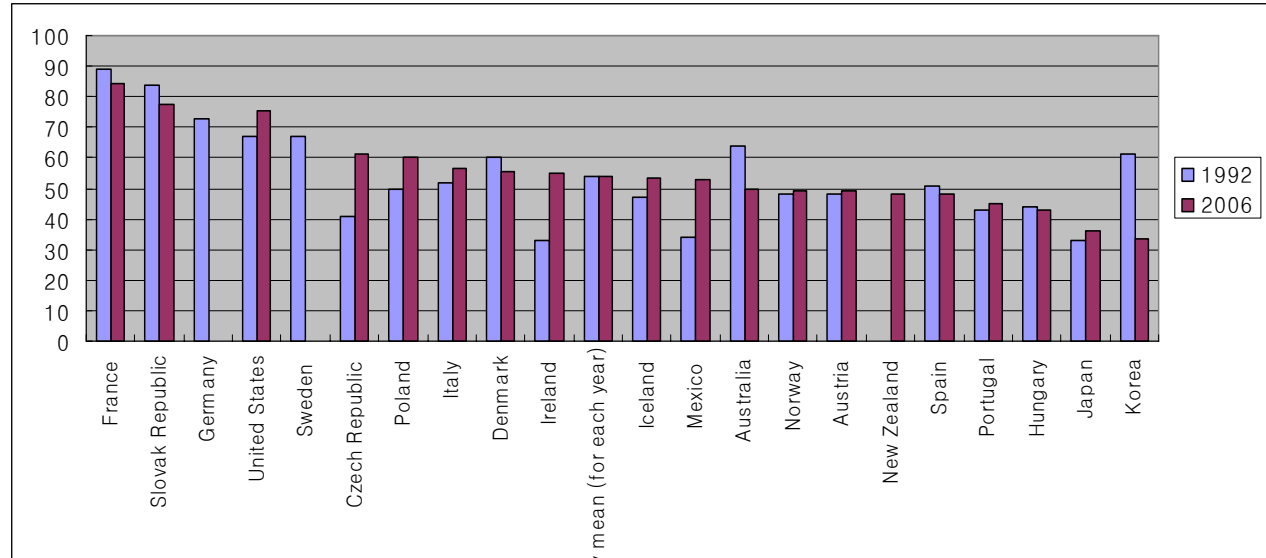
- IAC office incomes rely mostly on overhead fees from government R&D project
- Licensing fees take a very small part, 3.4% of total



# Composition of university R&D spending



# Share of university's basic research



# Further questions/topics

- How to quantify the value of Korean patents
  - No citation information
  - KPO introduced K-PEG (Korea Patent Evaluation and Grading)
- The linkage of scientific research and patenting, the effect of patenting on AR
- The effect of incentive schemes on faculty performances
- (Comparative) case studies
  - KAIST vs. MIT
  - The effect of policy changes: Bayh-Dole Act, IAC Act, etc
  - Successful technology transfer from U to B