

Economics and Management of Intellectual Property
HSE, Spring 2008

Lecture 10

“Intellectual Property in Financial Services”

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Outline of Core Lectures

1. Basics of IP Law (Välimäki)
2. Use of IPRs (Välimäki)
3. Basic Economics of IP
4. Designing Optimal IP Policy
5. Competition Policy and IP
6. Microsoft Cases in the US and Europe (Välimäki)
7. Economic arguments used (and not used) in selected legal cases (Välimäki)
8. Cumulative Innovation and IP
9. Basic IP Management
10. IP in Financial Services

Outline of the Lecture: "IP in Financial Services"

- i) Patent Quality
- ii) Financial Services Sector
- iii) The US Expansion of Patent Subject Matter (to Business Methods)
- iv) Its Economic Effects
- v) Its Legal Effects

i) Patent Quality

- There is a widespread concern of deteriorating patent quality in the US
 - i.e. there are patents that should not be patents
 - legally:
 - e.g. the PO makes type II errors and awards patents even if the application does not meet novelty requirement
 - economically:
 - e.g. non-obviousness standard too low from the welfare point of view

Reasons for the development:

- Expansion of patent subject matter
 - Harder to search prior art in new areas
- Increase in the number of patent applications
- The incentives of the PO examiners
 - Administrative changes
- Legal changes that have reduced the non-obviousness standard

Expansion of patent subject matter:

- Traditionally patents were granted on machines, industrial process etc
 - Currently in the US on software, biotechnology, mathematical algorithms, business methods, plants, animals, cell lines, genes, etc
- ⇒ Boundaries of the patent system under the heated debate

European Patent Convention Article 52:

- (1) European patents shall be granted for any inventions which are susceptible of industrial application, which are new and which involve an inventive step

- (2) The following in particular shall not be regarded as inventions within the meaning of [paragraph 1](#):
 - (a) discoveries, scientific theories and mathematical methods;
 - (b) aesthetic creations;
 - (c) schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers

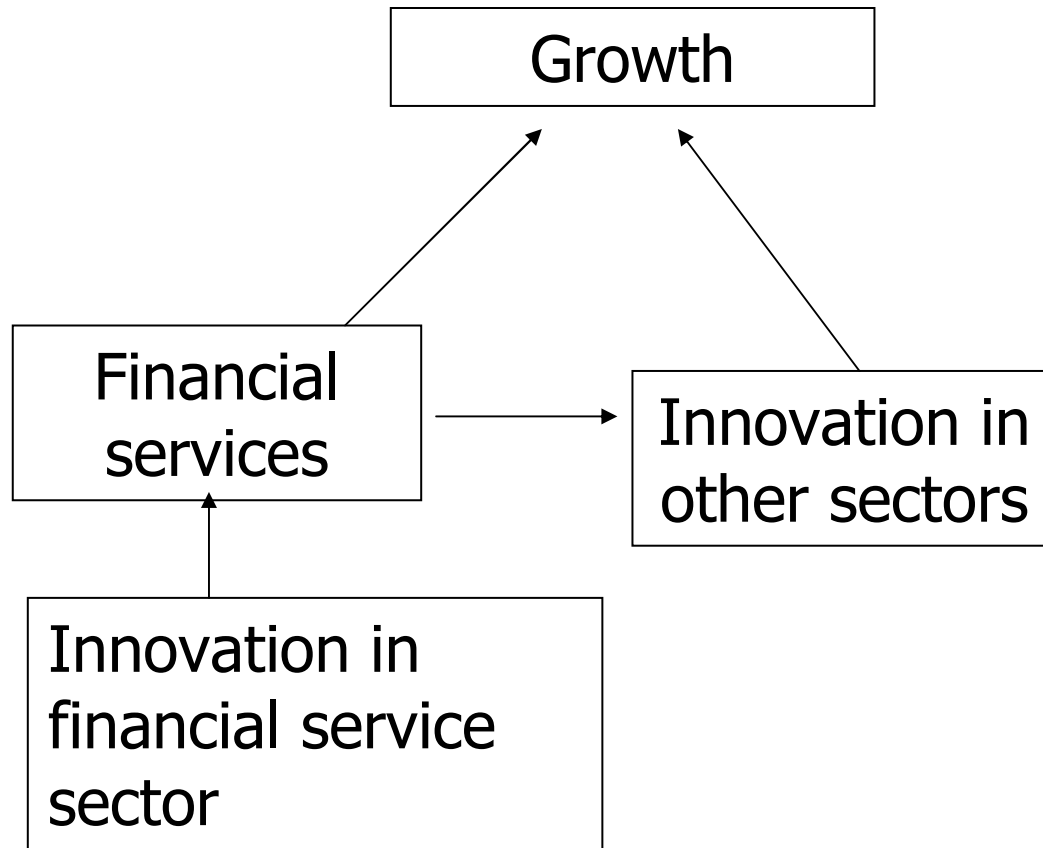
ii) Financial Service Sector

- financial intermediaries (e.g., banks, mutual funds, venture capitalists, brokers)
- investment service providers
- stock market infrastructure (e.g., exchanges and clearing & settlement)
- payment media (e.g., credit card companies, interbank payments)

Innovation in financial services:

- Product innovations. E.g., new derivatives, new mutual funds, new payment media
- Process innovations. E.g., new process for interbank payments, new methods for calculating the value of mutual funds
- Cumulative
 - E.g., equally weighted market fund 1971, value-weighted fund 1973....exchange traded funds 1990...holding company depository receipts 1998
- Rapid innovation \Rightarrow rapid diffusion

Welfare effects of financial innovation



Note: Financial innovation can be harmful

- Any innovation can be harmful due to the possibility of overinvestment/duplication
- But there is an extra reason to worry in case of financial services sector: It is heavily regulated because of

- Protection of small investors
- Stability

⇒ a lot of innovation to circumvent regulation

⇒ a concern for the stability

- Cf. securitization of loans (e.g. CDOs, CLOs) to off-balance sheet (to avoid capital-adequacy regulation) and current financial market turbulence

- Appropriating strategies in financial services traditionally:
 - Patents were not available (in such a way as today)
 - Secrecy does not work for product innovations
 - Copyrights?
 - do not prevent imitation
- ⇒ Imitation of product innovations rapid

⇒ Lead time & marketing the best means of appropriation

– Other mechanisms:

- Reputation & Size
- Complementary assets
- Joint ventures
- Regulatory barriers to entry

- However, the things have changed in the U.S & Asia over the past decade
- Europe?

- Patents have always been available for technological inventions in financial services sector, too
 - e.g. a USPTO patent, March 19, 1799, on an invention to detect counterfeit notes
- But now they are available (US, Asia) for abstract methods, mathematical formulas (or software that implements them)

iii) The US Expansion of Patent Subject Matter

- The entry of patents into Wall Street is a part of a broader story of how software/ business methods became patentable.
- The US Patent Law §101 says on patentability:

“Who ever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent thereof...”
- Prior to 1980 this was generally interpreted to mean that software and abstract ideas are not patentable

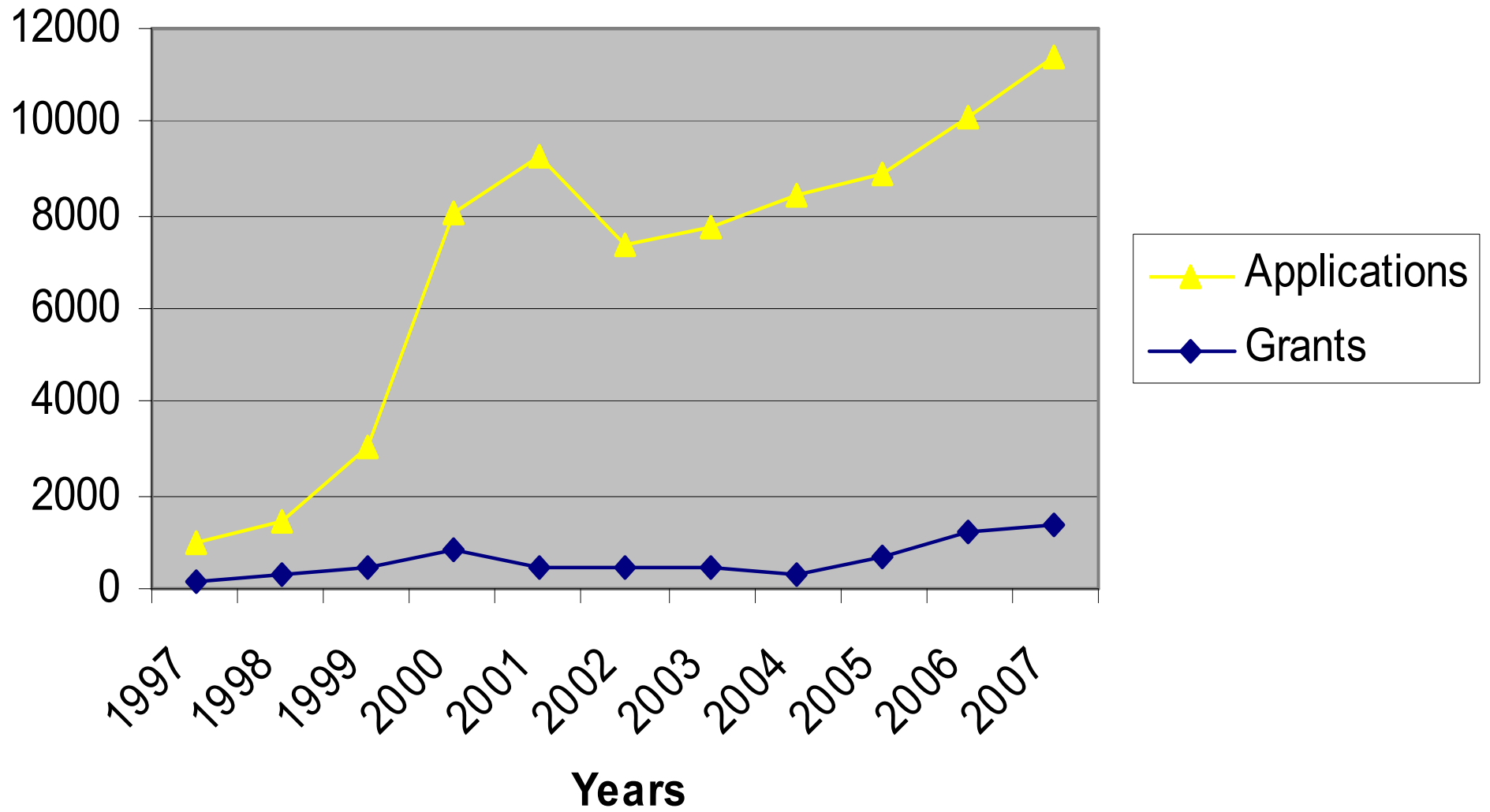
- 1981, the Supreme Court decision (*Diamond v. Diehr*) upheld the validity of a patent on an improved process for making rubber goods that was assisted by computer software program
- ⇒ patent lawyers started to write patent claims so that software patent applications did not *appear* to be patents on software
- Attention to tangible innovations such as new industrial processes, not software

- Patent claims were also written in terms of hardware that included software
- This became standard and accepted practice but it also became increasingly difficult to hide software in the patent claims
- By the mid 1990 there was little uncertainty about the patentability of software but still there were some ambiguity over which fields software patents were valid

- 1998, the Court of Appeals for the Federal Circuit (CAFC) decision in *State Street Bank and Trust v. Signature Financial Group*
- The case originates from a software program used to determine the value of mutual funds, on which Signature had obtained a patent in 1993.
- State Street sued to have the patent invalidated on the grounds that it covered a business method and was hence not patentable
- District court considered the patent invalid but the CAFC did not. The Supreme court declined to hear State Street's appeal

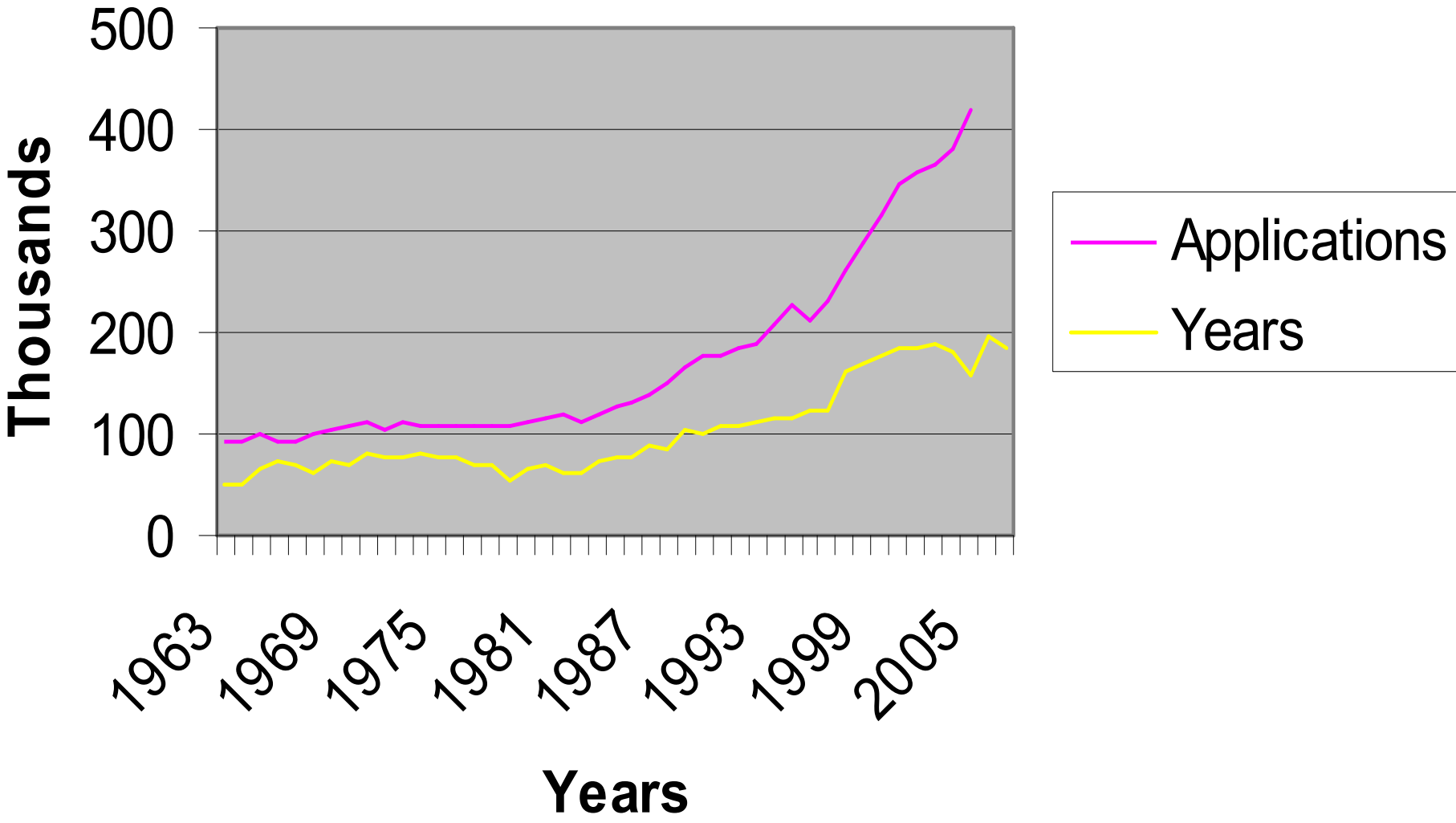
- The CAFC deliberately wanted to clarify the situation. §101 is unambiguous: Who ever invents or discovers *any* new and useful
 - ⇒ Business methods should be patentable, a finance patent just happened to one the table then...
 - ⇒ Surge of business methods and finance patents in the US (Figure)

Class 705



- The patentability of software and business methods is part of broader “pro-patent” shift of the US policy
 - CAFC was created in 1982. Its purpose was to unify the appellation procedure. As a by product it has
 - increased the probability that a patent is held valid
 - reduced non-obviousness standard
 - the success rates of patent holders in infringement cases
 - level of penalties (injunctions & damages) in case of infringement
 - but reduced the patent breadth
- ⇒ patents have become more *cost effective* ⇒ surge in patenting in general (Figure)

USPTO Patents



iii) Economic Effects of Business Method Patents

- Where does *State Street* lead? (Lerner, 2002)
- Business method patents for US financial services (Hunt, 2007)
- Empirical studies of IPRs & innovation
 - Theory and empirics are complements
- Doing decent empirical innovation research is difficult...
 - The basic problem is to measure inputs and outputs of innovation process

- How to measure R&D output?
 - patents vs. other ways (cf. Lerner 2002, 2006)

A typical starting point:

- A "patent production function": $\text{Patents} = f(\text{R\&D expenditure, controls})$
 - Cf. Scotchmer's critique: ideas model vs. production function
- Patents/applications are taken as a proxy for innovation output and some measure for R&D expenditures as input

- How to identify (finance) patents? In general two methods to assign patents to an industry, an easier and a more difficult
 - “Automatized”, i.e., using the patent classification system developed by the POs
 - “Hand-picking”, i.e., reading the patents and classifying them independently

- Problems with the easier approach:
 - patent classes are made so as to aid prior art search, not to aid social scientist \Rightarrow they do not correspond economic concepts of industry, markets or technology
 - the classification system changes over time
 - patents are reclassified
- But because the easier way is, well, easier, it has been widely used and is of course a natural starting point

- e.g. Lerner's analysis limited to five subclasses of the USPTO class 705 "Data processing, financial, business practice, management, or cost/price determination" \approx "Business methods"
 - 705/35: Finance
 - 705/36: Portfolio selection, planning, or analysis
 - 705/35: Trading, matching, or bidding
 - 705/35: Credit or loan processing
- In addition, 705/4: Insurance, from which the finance patents are hand-picked

Special problems when using class 705:

- Patent examiners mainly search patents for prior art
 - ⇒ problems in new patent subject matter areas where the prior art is not in patent files
- because of the wide-spread concern for patent quality, the USPTO introduced a second-pair of eyes review of patent applications in class 705
 - ⇒ finance patents drafted to be classified in 902 "Electronic Funds Transfer"
- An example of strategic patent drafting to be classified in a favorable way

- Lerner focuses on finance innovations that are business methods:
 - a part of finance patents
 - excludes many banking patents, payment media patents etc
 - A small part of business method patents
- According to this quite narrow definition of finance patents, 445 finance patents awarded 1971-2000
- Many investment banks among the largest patent holders

U.S. patent subclasses (705/35, 705/36, 705/37, 705/38, and part of 705/4). Panel A presents the most frequent assignees of these patents, and the number of awards each received. Companies that had merged as of March 2000 are combined in the table. Panel B presents summary information on the types of entities assigned the patent awards in the sample. The sample is compared to the distribution of all patent awards in 1998.

Panel A: Largest Patentees in the Sample

<u>Entity</u>	<u>Number of Patent Awards</u>
Merrill Lynch & Co.	16
Citigroup	14
Hitachi	10
Reuters	10
Fujitsu	9
NCR Corporation	8
Optimark Technologies	5
Casio Computer	4
General Electric	4
International Business Machines	4
Walker Asset Management	4
Cantor Fitzgerald	3
College Savings Bank	3
Financial Engines	3
Foreign Exchange Transaction Services	3
Golden 1 Credit Union	3
Huntington Bancshares	3
Sun Microsystems	3
Xerox Corporation	3

Panel B: Summary Information on Assignees of Finance and All Patents

Why these banks?

- Use the “patent production function”: $\text{Patents} = f(\text{R\&D}, \text{controls})$
- Assume patents/applications measure innovation output and assume we have identified finance patents correctly enough

Next problem: Distribution of patent values highly skewed

- only a small fraction of patents is valuable,
- most are useless and are hence not kept in force for a long time (less than 50% are kept in force 10 years)

- the best way to address this problem is to employ *forward citations*
 - citations to the patent by subsequent patents
 - patent applicants must cite the relevant prior art they are aware, if not the patent can be held invalid due to “fraud on the patent office”
 - strong correlation between patent value and the number of citations
- each patent weighted by citations, i.e., one plus number of citations it has received as of 2000
- new problem: the patents had different periods to be cited. *Ceteris paribus*, older ones should receive more citations than new ones

⇒ “normalized” citation-based weight (**W**) for each patent

$$W = \frac{1 + \sum_{t=A}^{2000} C_t}{1 + \sum_{t=A}^{2000} P_t}$$

- where **A** = is the year of award, **C_t** is the actual number of citations received year t
- **P_t** is the predicted number of citations in year t = the average number citations of similar patents (same classification and same age) in the past
- so **W** should be a more robust dependent variable (than patents/applications) in the LHS of the regression

- Independent/explanatory variables in the RHS, 30 largest investment banks
 - The volume of equity securities underwritten by the investment bank
 - The volume of debt securities underwritten by the investment bank
 - The investment bank's reputation among its peers from "tombstone announcements"
 - The bank's R&D effort
 - Usually R&D expenditures or R&D staff used as a proxy, for banks difficult to find this information
 - the average share of bank's employees on the editorial/advisory boards of academic-practitioner journals used as a proxy

- A problem with the independent variables is that there has been a lot of mergers in the banking industry
 - investment banks measured as if they were in the current configuration
 - i.e., if bank ***k*** consisted previously from banks ***h*** and ***j***, the observations from ***h*** and ***j*** were combined

- Specifying the “patent production function”:

$$Y_{it} = \beta_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \dots + u_{it}$$

- Weighted patent awards used from 1980-1997 in the LHS and characteristics of 30 largest investment banks in the RHS

⇒

March 2000 are combined.) The dependent variable in the first four regressions consists of the number of patents applied for in the time period, awarded by the U.S. Patent and Trademark Office between January 1971 and February 2000, classified in one of five U.S. patent subclasses (705/35, 705/36, 705/37, 705/38, and part of 705/4), and assigned to that entity. The dependent variable is the same in the final three regressions, except that each patent is weighted by the normalized total number of citations. The independent variables are the institution's volume of debt and equity underwriting (expressed in billions of 1999 dollars), the bank's "Carter-Manaster" reputation rating (expressed on a scale of 9.0 to 0.0, with 9.0 being the most prestigious), a ranking of the institution's connection to the academic community (expressed as a one hundred times its percentage share of the investment bank board seats at two academic-practitioner journals), dummies for each bank (in the within regression specifications only and not reported), and (in all but the between specification) dummies for the first two time periods. The first regression employs a Poisson specification; the others employ an ordinary least squares specification. Absolute heteroskedastic-consistent t-statistics in brackets (except in the between specifications, where absolute t-statistics are reported).

	<i>Dependent Variable: Patent Applications</i>				<i>Dependent Variable: Weighted Applications</i>		
	Poisson and	OLS Specification			OLS Specification		
	<u>Pooled</u>	<u>Pooled</u>	<u>Within</u>	<u>Between</u>	<u>Pooled</u>	<u>Within</u>	<u>Between</u>
Equity underwriting volume	0.005 [0.36]	-0.004 [0.17]	0.01 [0.32]	-0.02 [1.12]	0.01 [0.11]	-0.01 [0.26]	-0.02 [0.37]
Debt underwriting volume	*0.004 [1.74]	0.004 [1.25]	0.003 [0.52]	**0.005 [2.12]	0.005 [0.72]	0.001 [0.05]	*0.01 [1.94]
Reputation ranking	0.33 [0.63]	*-0.07 [1.76]	0.04 [0.61]	-0.07 [1.03]	-0.05 [0.35]	0.06 [0.44]	-0.27 [1.26]
Academic connection measure	*0.07 [1.80]	***0.07 [4.49]	0.03 [0.34]	***0.10 [3.47]	***0.15 [3.90]	-0.07 [0.44]	*0.14 [1.73]
Is observation from 1980-85?	1.23 [0.83]	0.32 [1.04]	0.52 [1.40]		0.82 [0.91]	-0.32 [0.22]	
Is observation from 1986-91?	-0.17 [0.20]	-0.06 [0.34]	-0.02 [0.06]		0.07 [0.13]	-0.80 [0.59]	
Log likelihood	-47.24						
χ^2 -statistic	100.82						
F-statistic		9.27	5.87	11.51	7.56	200.57	7.37
p-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R ²		0.39	0.69	0.49	0.22	0.69	0.43
Number of observations	95	95	95	44	95	95	44

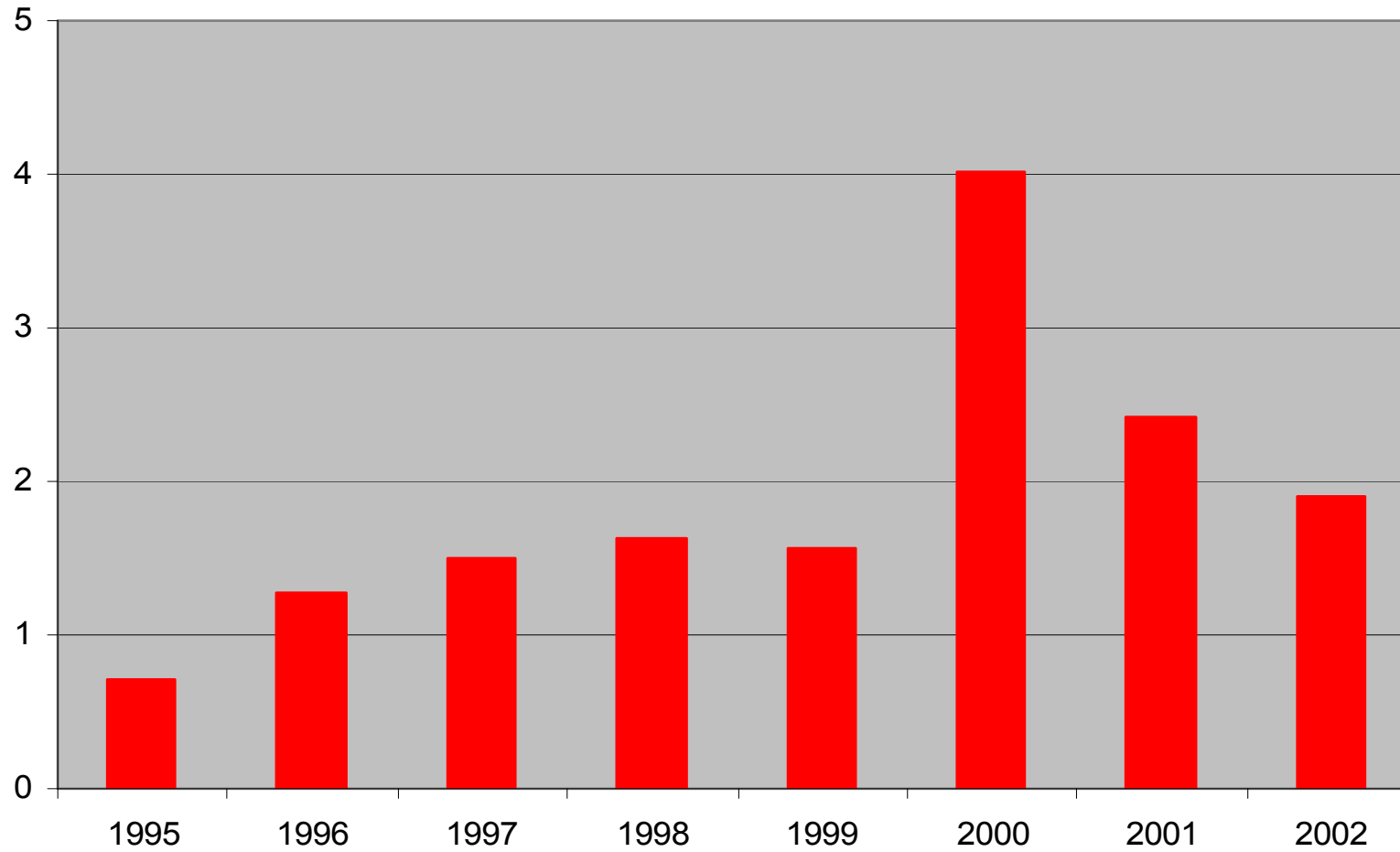
- Measure for academic ties/R&D effort significant
 - Standard critique:
 - Endogeneity, i.e., “the chicken-and-egg” problem
 - Omitted variables
 - How good proxy of R&D effort is this ?
- ⇒ measuring innovation input even more difficult than output measurement
- esp. in financial services

Welfare Effects of Business Method Patents

- A strengthening of legal protection of IP in financial services
- Basic theory predicts that this should
 - increase DWL
 - increase profits
 - increase R&D
 - A *necessary* condition for a welfare-improvement
 - this is also what the production-function model assumes

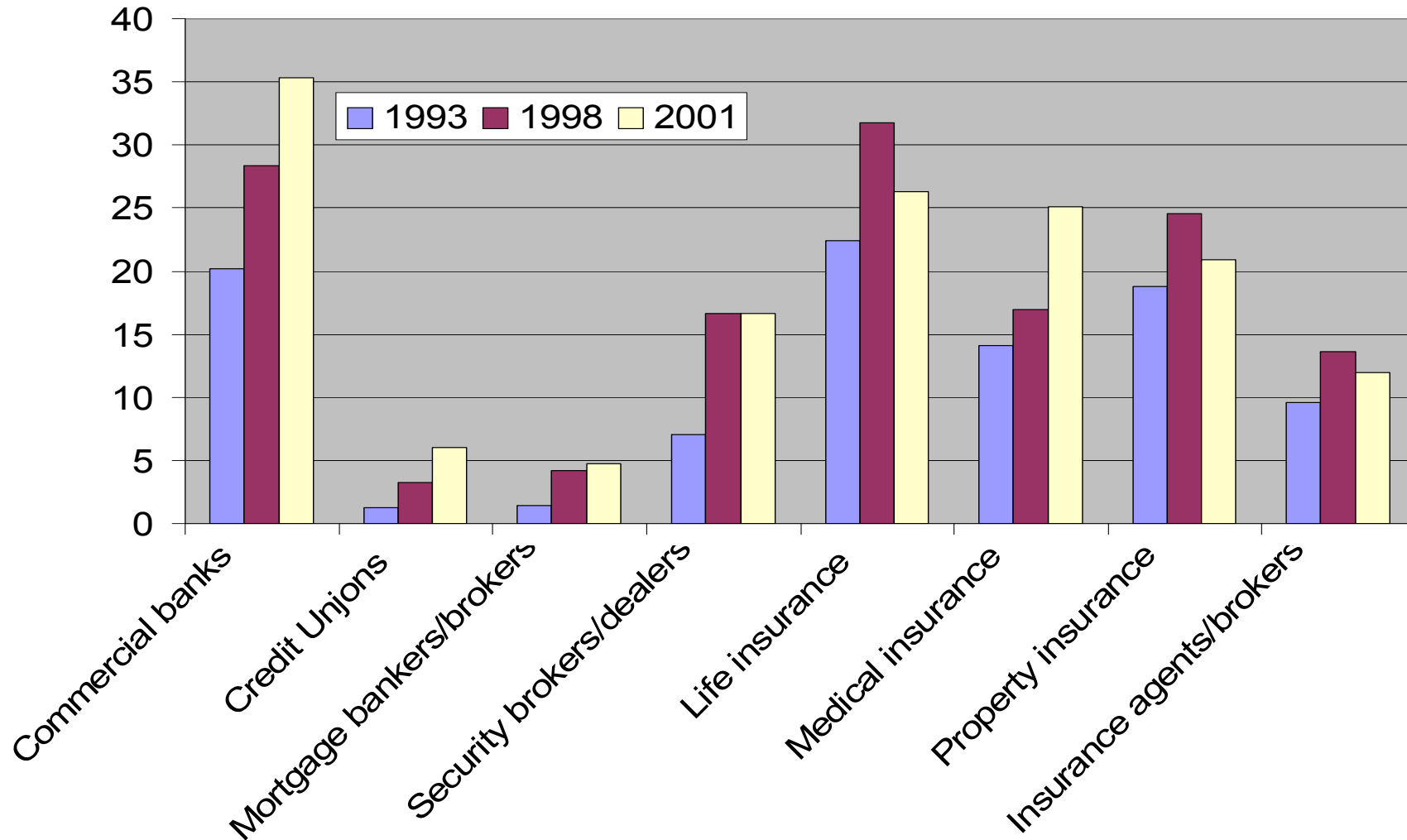
- Effects on DWL?
- Effects on profits
 - Boscaljon, Filbeck and Smaby (2006) use event study and find a positive stock-price reaction to an issued patent of Class 705
 - This is consistent with the positive incentive effect and negative DWL but does not prove them
- Effects on R&D
 - Measurement problems!
 - Survey evidence on financial service sector R&D:

R&D in Financial Services (\$US billions)

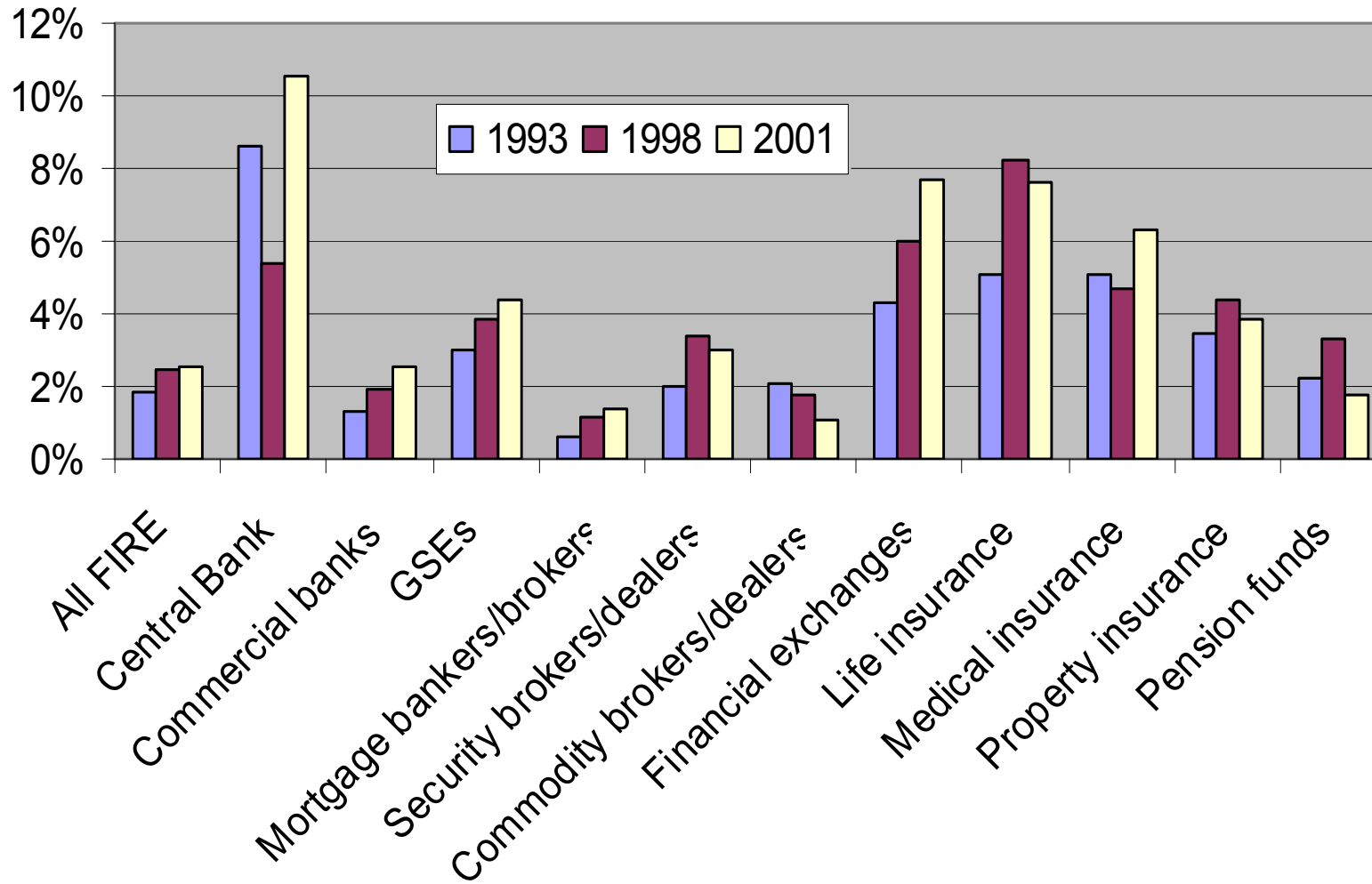


- The R&D effort seems to have risen but the trend predates the State Street
- But the amounts are so small (e.g. respondents total net sales \$425 billion 2003) that the evidence hardly reliable
- Another, and probably more reliable, proxy: employment of engineers and scientists

Employment of scientists and engineers (thousands)



Employment of engineers and scientists as a share of workforce



Conclusion

- # patents have clearly gone up
 - Effects on private value of financial institutes positive
 - R&D effort in financial services seems to have risen over time but seems to predate the State Street
 - hard to say if the State Street has played any role here
 - Hunt's analysis descriptive due to lack of sufficient data
- ⇒ Need better data so that we can use rigorous methods to separate cause and effect

v) Legal Effects of Business Method Patents

- Concern for bad patent quality and overprotection
 - prior user rights 1999
 - second-pair of eyes review 2001
 - A comprehensive legislation reform (coming this year)
 - three Supreme Court decisions 2006-2007

1. Injunctions: "*eBay v MercExchange*"

- District court decision 2003 finds eBay's "Buy it now" infringing two MercExchange patents
 - Court awarded damages but no injunction
- ⇒ MercExchange appealed to CAFC which awards an injunction, too
- (but invalidates one of the MercExchange patents)
 - (2005 USPTO re-examination invalidates also the other patent)
- CAFC: Injunctions should be denied only in exceptional circumstances

- In 2006 the Supreme Court reversed the CAFC decision and send the case back to district court
- required a 4-factor test for an injunction
 - i) a plaintiff must demonstrate irreparable injury
 - ii) monetary damages cannot compensate
 - iii) the balance of hardships favor an injunction
 - iv) an injunction would not harm the public interests
- in addition, a district court's decision on injunction may be appealed only on grounds of an abuse of discretion

- the Supreme Court decision should make harder to obtain injunctions
- ⇒ In 2007 the original district court used the 4-factor test and upheld its original decision not to impose an injunction

2. **Non-obviousness standards:** "*KSR International v. Teleflex*"

- obviousness assessed from the perspective of a hypothetical "person having ordinary skill in the art"
- problem: novel combinations of pre-existing elements seem often obvious ex post
- CAFC: unless the prior art clearly suggests the novel combination, it is non-obvious
- In 2007 the Supreme Court: patents should not be granted for "advances that would occur in the ordinary course without real innovation"

- ⇒ PHOSITA should be related to the observed rate of innovation in an industry
- A tightening of non-obviousness standard
 - Important in particular for “new areas” such as business methods

- Used e.g. CAFC decision (2007) of *in re Trans Texas Holding Corp* which upheld USPTO's rejection of a finance patent on obviousness ground
- the innovation is a software system of inflation-adjusted deposit and loan accounts
- USPTO & CAFC evidence
 - i) a patent granted on 1983 to use computer to manage a set of accounts
 - ii) an english language book from 1975 that described how the Finnish banks have used inflation-adjusted deposit and loan accounts
- combining i&ii) makes the innovation obvious

3. Licencee's right to seek declaratory judgments:

"MedImmune v. Genentech"

- Can you purchase a license and simultaneously challenge the licensor for the patent invalidity?
- In 2007 the Supreme Court overturned a lower court decision and answered "yes"