Patent Data as Indicators

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Outline

- Overview – patents as indicators
- Patent citations
  - as measures of innovation value
  - as measures of knowledge flows
- Data needs

Some surveys available

- Basberg (1987), "Patents and the Measurement of Technological Change: A Survey of the Literature," *Research Policy.*
- Pavitt, Keith (1988), "Uses and Abuses of Patent Statistics," A. F. J. van Raan (ed). *Handbook of Quantitative Studies of Science and Technology.* Amsterdam: Elsevier Science Publishers.
- Griliches (1990), "Patent Statistics as Economic Indicators: A Survey," *Journal of Economic Literature.*
- Collection of references to citations papers on my website

Patents as indicators

- A patent is a property right to a knowledge asset => patent counts can be useful measures of innovative output
  - Counts at the firm, industry, country level over time
  - Counts weighted by the number of subsequent citations that the patents receive
- Citations from one patent to another
  - an imperfect but useful map of the links between these “bits” of output or knowledge

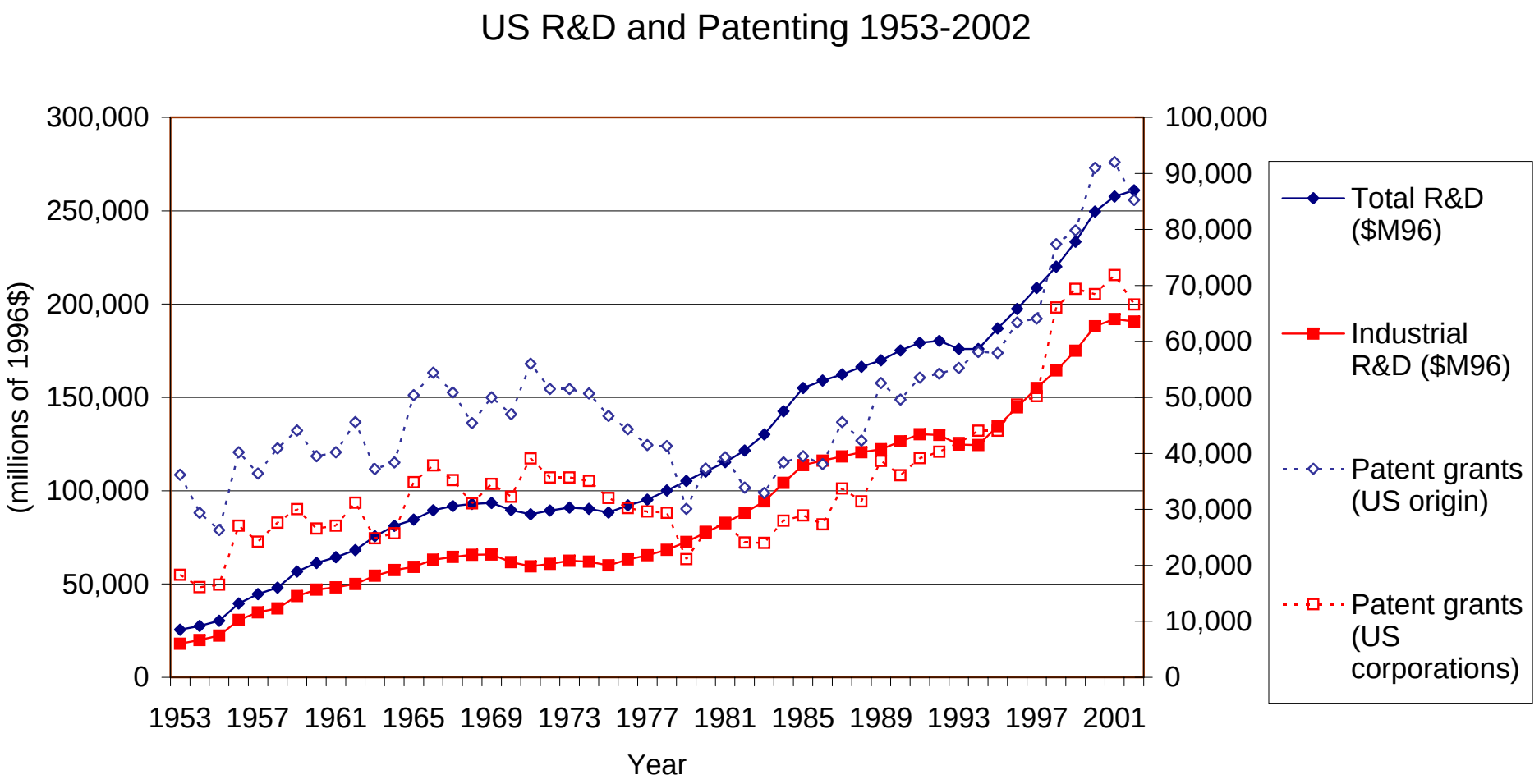
But.....

- Using patents as indicators requires some understanding of what they mean
  - how and why they are taken out
  - how they are administered
  - how they are enforced
  - how all this changes over time

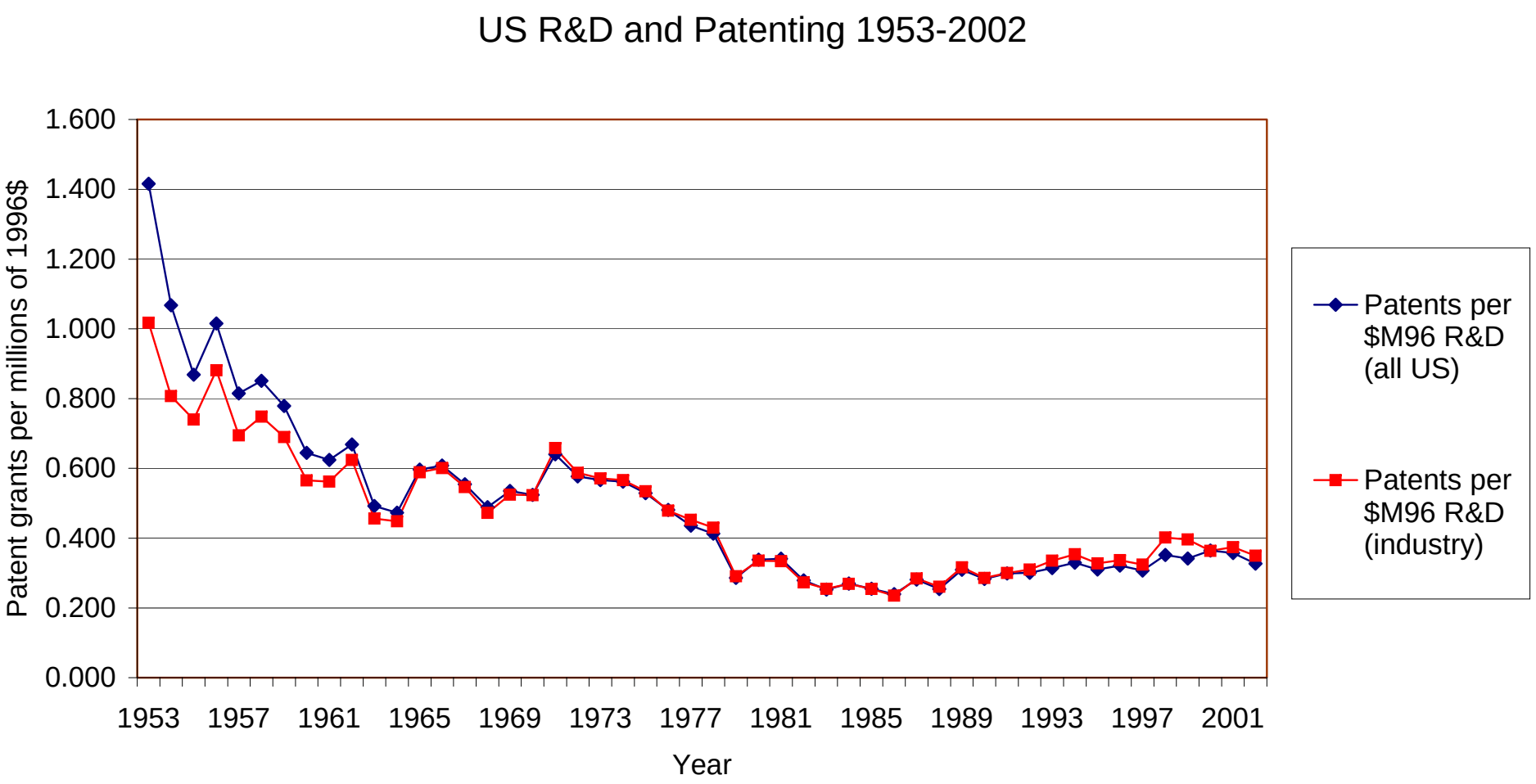
Pavitt (1988)

- Three sources of bias in patent counts:
  1. Differences across countries in economic costs and benefits of patents – rigor of exam; size of market; subject matter coverage
  2. Differences among technologies and sectors in the importance of patents as protection against imitation
  3. Differences among firms in propensity to patent, especially unimportant innovations; filing under different names

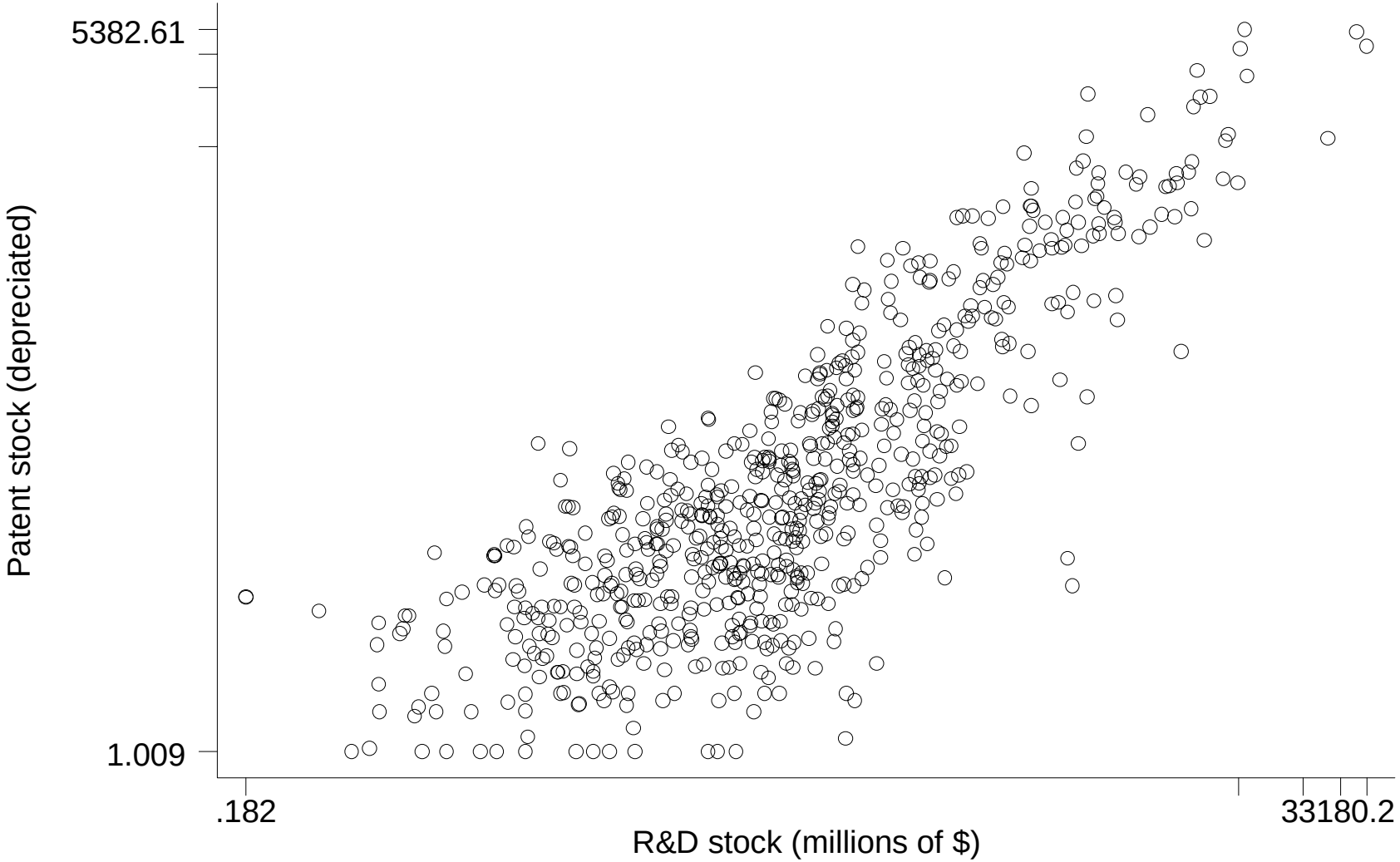
Time series relationship



Time series relationship



Patent stock versus R&D stock (log scale) corr = 0.79



US Manufacturing Sector 1992

Measuring innovation using patents – early literature

- Schmookler (1966 book) – pioneer in the use of patent statistics
- Scherer (*AER* 1965) - oil, chemicals, steel industry
- Griliches et al (NBER ~1980) – first work using computerized USPTO data

Griliches et al

- Patents strongly related to R&D across firms, elasticity close to one (proportional)
- Controlling for unobserved differences across firms in propensity to patent, elasticity lower (about 0.3)
- Difficult to determine lag relationship because R&D very smooth over time within firm
- *But*, in the presence of R&D, patents added little explanatory power for sales, profits, and market value. Why?

  Skewness of the distribution of patent value or importance

What are patent citations?

- Somewhat like citations in a research paper:
  - References to prior technology, either patents or other scientific literature on which the current patent builds or which it uses
  - Some added to avoid infringement (limit scope, defense against suits)
  - Some added by the USPTO examiner (not used by inventor)
  - Some added for “teaching” (like survey articles)
- USPTO differs slightly from EPO in citation practice
  - USPTO: all relevant citations
  - EPO: minimum number needed to cover prior art

United States Patent ***4,310,440***
Wilson , et al. **January 12, 1982**

Crystalline metallophosphate compositions

Abstract

A novel family of crystalline, microporous aluminophosphate compositions is synthesized by hydrothermal crystallization at elevated temperatures of aluminophosphate gels containing a molecular structure-forming template. The family comprises a number of distinct species, each with a unique crystal structure. Calcination removes volatile extraneous matter from the intracrystalline void space and yields microporous crystalline adsorbents with uniform pores, the dimensions of which vary, among the individual species, from about 3A to 10A in diameter. The compositions represent a new class of adsorbents of the molecular sieve type, and also exhibit properties somewhat analogous to zeolitic molecular sieves which render them useful as catalysts or catalyst bases in chemical reactions such as hydrocarbon conversions.

Inventors: **Wilson; Stephen T.** (Shrub Oak, NY), **Lok; Brent M.** (New York, NY), **Flanigen; Edith M.** (White Plains, NY)
Assignee: **Union Carbide Corporation** (New York, NY)
Appl. No.: **166333**
Filed: **July 7, 1980**

Current U.S. Class: **502/208**; 208/112; 208/114; 208/135; 208/136; 208/138; 208/143; 208/213; 208/254H; 423/305; 502/510; 502/511; 585/418; 585/419; 585/467; 585/475; 585/481
Intern'l Class: B01J 027/14; B01J 031/02; C01B 015/16
Field of Search: 252/435,430 423/305

References Cited [Referenced By]

U.S. Patent Documents

References Cited [Referenced By]

U.S. Patent Documents

2282602	May., 1942	Drennan	252/435.
2330115	Sep., 1943	Drennan	252/435.
3941871	Mar., 1976	Dwyer et al.	423/326.
3969273	Jul., 1976	Brown et al.	252/435.
4061724	Dec., 1977	Grose et al.	423/335.
4066572	Jan., 1978	Choca	252/435.
4132669	Jan., 1979	Choca et al.	252/435.

Other References

Bull. Soc. Chim., France, 1961, F. D'Yvoire.

Primary Examiner: Metz, Andrew
Assistant Examiner: Wright, William G.
Attorney, Agent or Firm: Miller, Richard G.

Claims

What is claimed is:

1. Crystalline aluminophosphates each having a framework structure whose chemical composition expressed in terms of mole ratios of oxides is:

Al sub.2 O.sub.3 :1.0+-0.2 P sub.2 O.sub.5 :

each of said framework structures being microporous in which the pores are uniform and have nominal diameters within the range of about 3 to about 10 Angstroms, an intracrystalline adsorption capacity for water at 4.6 torr and 24 degree. C. of at least 3.5 weight percent, the adsorption and desorption of water being completely

Patent Database Search Results: ref/4,310,440 in 1982-2001 - Netscape

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Results of Search in 1982-2001 db for:
REF/4,310,440: 219 patents.
*Hits **1** through **50** out of **219***

Next 50 Hits

Jump To

Refine Search ref/4,310,440

	PAT. NO.	Title
1	6,187,981	Process for producing arylalkanes and arylalkane sulfonates, compositions produced therefrom, and uses thereof
2	6,140,263	Process for the production of supported zeolite membranes, and zeolite membranes so produced
3	6,060,415	Aligned molecular sieve crystals grown on anodic alumina membrane
4	6,051,746	Oxygenate conversions using modified small pore molecular sieve catalysts
5	6,020,533	Hydrocarbon conversion processes using crystalline manganese phosphate compositions
6	6,001,328	Crystalline metallophosphates
7	5,989,518	Process for synthesizing and controlling the particle size and particle size distribution of a molecular sieve
8	5,976,491	Synthesis of and composition of ECR-40, large pore aluminophosphate
9	5,942,104	Alumina source for non-zeolitic molecular sieves
10	5,939,349	Method of preparing non-zeolitic molecular sieve catalyst
11	5,912,393	Metallo aluminophosphate molecular sieve with novel crystal morphology and methanol to olefin process using the sieve
12	5,892,125	Preparation of n-butyraldehyde and/or n-butanol
13	5,879,655	Method of making microporous non-zeolitic molecular sieves
14	5,830,427	Metallochalcogenide microporous compositions having metal-metal bonds
15	5,785,748	Titanium dioxide pigments
16	5,780,003	Crystalline manganese phosphate compositions

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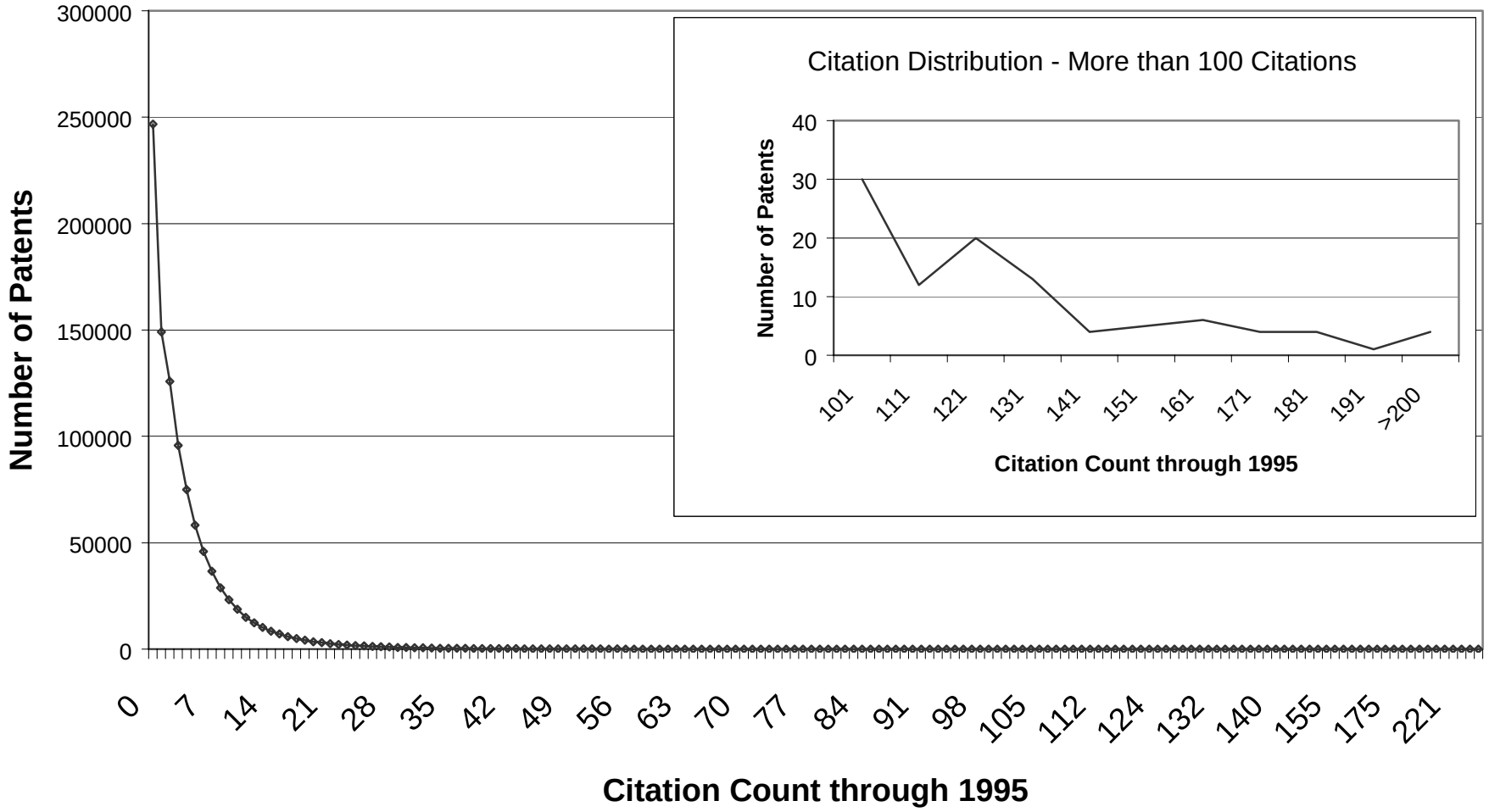
Some facts about U. S. citations

- More valuable patents are cited more often
- One quarter of patents receive no citations
- 0.01% receive more than one hundred citations
- Lag distribution is skew to the left with a mode at about 3.5 years.
  - Most cites happen by 10 years, but there can be long lags (30 years)
- Number per patent has increased recently with the advent of computerized search

Figure 3
Citation Distribution



Weighting by citations

- Carpenter and Narin (1981) – patents associated with more important innovations more likely to be cited
- Trajtenberg (RJE 1990) – willingness to pay for CAT scanners related to citations
- Klock and Shane (AER 1995) - market value of citation-weighted patents in semiconductors
- Austin (1993) – value increase for biotechnology patent grant related to subsequent citations
- Hirschey et al (1998); Lev et al (1998) - citation-weighted patents as a measure of intangible assets
- Harhoff, Scherer, et al (1999) – patents on inventions with higher economic value more likely to be cited in both US and Germany

Hall, Jaffe, Trajtenberg
Rand Journal of Economics 2005

- Large firm level study which relates market-book value ratio to
  - Stock of R&D spending
  - Average patent yield per R&D
  - Average cite yield per patent
- Findings
  - Cites per patent are more important than patent yield itself
  - Increase of one cite per patent => increase of 3% in market value
  - Below the median, cites per patent has no effect, but
    - 10% increase in value if cites per patent average 7-10
    - 35% increase in value if cites per patent average 11-20
    - 54% increase in value if cites per patent average above 20
  - Self-cites worth twice as much as other cites (appropriability)
- Timing – do citations received before value is measured matter more or less than those received after?
  - Less, although they are useful for forecasting future cites
  - Predictable and unpredictable citations approximately equal

Other value correlates

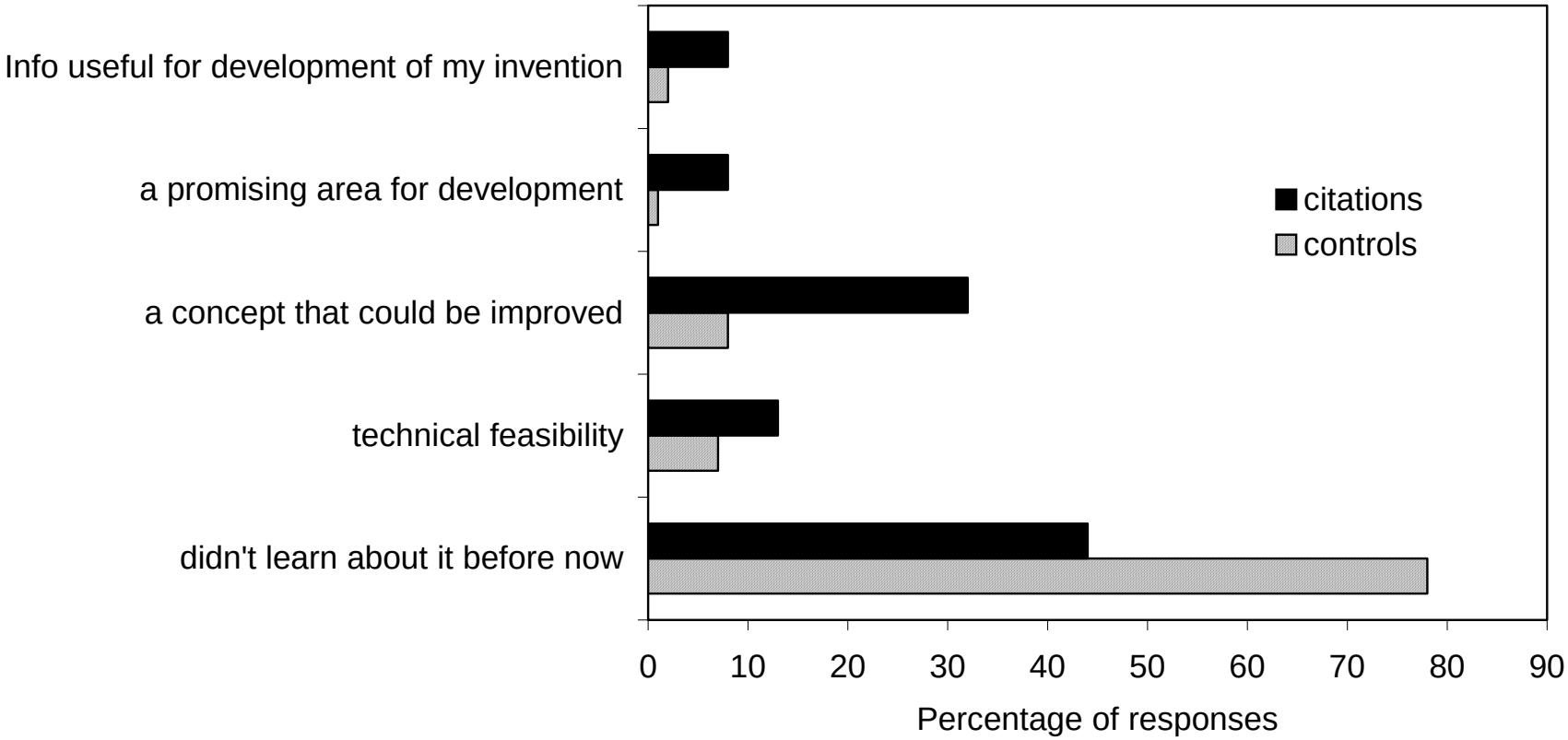
- Opposition or litigation (obviously)
- Family size
- Backward citations as well as forward
- Claims, in some cases
  - independent claims if available
  - Cites per claim
- Type of citation
  - X and Y more valuable than others (EPO)

Citations as indicators of knowledge flow

- Can they be used in this way?
- Jaffe, Trajtenberg, Fogarty surveyed 1300 inventors (37% response), find
  - About half correspond to some kind of knowledge flow
  - About one quarter to a very substantial flow
  - Remainder are primarily those added by others (not the inventor)

Jaffe, Trajtenberg, Fogarty (2002)

Distribution of answers to:
What did you learn from the previous invention?



Applications

- "Self" measure in HJT
- Geographic localization
  - Henderson, Jaffe, and Trajtenberg
  - Many successor papers
- Branstetter (2000); Macgarvie (2003)
  - Citations used to measure knowledge flow induced by exporting or importing
  - French firms begin exporting to Germany
    - Do they cite German patents more after than before?
- Spillover from alliances?
  - Ham (1997) – Sematech
  - Mowery and coworkers – universities and industry

Conclusions

- Patents as indicators
  - Can be useful, especially citation-weighted – correlated with value, R&D, litigation, profits, etc.
  - However, important, especially over time, to understand the impact of policy changes on these indicators.
- Citations
  - Defensible as a partial measure of knowledge transfer
  - Suggest spillover localization in region and country

Data needs

- Major patent offices have put an enormous amount of data online, *but*
  - more suited to search than statistical analysis
  - researchers need to download large blocks of data
  - ftp access desirable

Data needs

Two major problems for research:

1. Inconsistent assignee names, and no common register of assignees (even within POs)
2. Classification by industry, which needs to be done by patent, not by tech class

NBER Patent Citations Data File

Available at http://www.nber.org/patents

http://emlab.berkeley.edu/users/bhhall/bhdata.html

- ~3 million U.S. patents granted between January 1963 and December 1999 (now updated to 2002)
  - Patent number, application and grant dates
  - Country and state of first inventor
  - Main US patent class; number of claims
  - Number of citations, forward and backward; generality and originality measures based on citations
- All citations made to these patents between 1975 and 1999 (over 16 million).
- Match of patenting organizations to Compustat (the data set of all firms traded in the U.S. stock market).
  - enables ownership assignment for part of the dataset

United States Patent 6,175,824

Breitzman , et al. **January 16, 2001**

Method and apparatus for choosing a stock portfolio, based on patent indicators

A portfolio selector technique is described for selecting publicly traded companies to include in a stock market portfolio. The technique is based on a technology score derived from the patent indicators of a set of technology companies with significant patent portfolios. Typical patent indicators may include citation indicators that measure the impact of patented technology on later technology, Technology Cycle Time that measures the speed of innovation of companies, and science linkage that measures leading edge tendencies of companies. Patent indicators measure the effect of quality technology on the company's future performance. The selector technique creates a scoring equation that weights each indicator such that the companies can be scored and ranked based on a combination of patent indicators. The score is then used to select the top ranked companies for inclusion in a stock portfolio. After a fixed period of time, as new patents are issued, the scores are recomputed such that the companies can be re-ranked and the portfolio adjusted to include new companies with higher scores and to eliminate companies in the current portfolio which have dropped in score. A portfolio of the top 10-25 companies using this method and a relatively simple scoring equation has been shown to greatly exceed the S&P 500 and other indexes in price gain over a ten year period.

Inventors: Breitzman; Anthony F. (Cedarbrook, NJ); Narin; Francis (Ventor, NJ)
Assignee: CHI Research, Inc. (Haddon Heights, NJ)

Appl. No.: 09/353613 **Filed:** July 14, 1999

United States Patent 6,175,824

Current U.S. Class: 705/36; 705/10; 705/35; 705/37
Intern'l Class: G06F 017/60
References Cited [**Referenced By**]
U.S. Patent Documents
5761442 Jun 1998 Barr et al. 705/36.; 5819238 Oct 1998 Fernholz.; 5934674 Aug 1999 Bukowsky 273/278; 5978778 Nov 1999 O'Shaughnessy 705/36; 6035286 Mar 2000 Fried 705/36.
Other References
...
CHI Research, Inc. Introduces Tech-Line Analysis Tool Technology, Information Today, v 15, n 9, p 66,Oct. 1998.
Deng, Z., Lev, B., and Narin, F. "Science and Technology as Predictors of Stock Performance" (Financial Analysts Journal, vol. 55, No. 3, May/Jun. 1999, pp. 20-32).
....
Griliches, Z. "Patent Statistics as Economic Indicators: A Survey" (Journal of Economic Literature, vol. XXVIII, Dec. 1990, pp. 1661-1707).
Trajtenberg, M. "A Penny for Your Quotes: Patent Citations and the Value of Innovations" (Rand Journal of Economics, vol. 21, No. 1, Spring 1990 pp. 172-187).
Bronwyn, H.H., Jaffe, A. and Trajtenberg, M. "Market Value and Patent Citations: A First Look" (Apr. 1998. Paper prepared for the Conference on Intangibles and Capital Markets, New York University, May 15-16, 1998, pp. 1-34).

United States Patent 6,175,824

Claims

1. A computer-implemented method of selecting a portfolio of company stocks for a client which is predicted to have future performance that achieves a predesired financial outcome, the method comprising:

(a) calculating a score for a plurality of companies whose stock may be potentially selected to be in the portfolio by using the equation: ##EQU3##

wherein x.sub.i are company indicators which include industry normalized patent indicators, .alpha..sub.i are weighting coefficients for the respective company indicators, at least one of the weighting coefficients being non-zero, the weighting coefficients being selected so that companies which receive a high score are predicted to contribute to achieving the predesired financial outcome, and .beta..sub.i are weighting exponents, and that companies which receive a low score are predicted to not contribute to achieving the predesired financial outcome, each company being assigned to a predefined industry;

(b) ranking the calculated scores from highest to lowest and generating recommendations of which company stock to purchase for the portfolio based upon the ranking; and

(c) displaying the recommendations on a summary report for review by the client or the client's financial manager, or buying amounts of company stock for the portfolio in accordance with the recommendations, or selling amounts of company stock from the portfolio in accordance with the recommendations.

Etc. for 62 further claims