

# **The scientific and technological profile of firms involved in nanotechnologies**

**GAEL**

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**May 20th, 2006**

## Main question

- ❖ Are nanoS&T the same story as biotech?
  - ❖ Competence destroying activity which leads to a reduction of innovation performance of incumbents?
  - ❖ High innovativeness of start-ups, spin-offs SMEs
  - ❖ and finally what does drive their R&D performances?

# What's different about nano?

- ❖ Similarities with bio
  - ❖ Closeness to science
  - ❖ Key enabling discovery (Grilichesian breakthroughs) : AFM, STM
- ❖ But ...
  - ❖ Nano borrows from very different and independent fields (convergence issue)
  - ❖ Large infrastructures needed from the very beginning (clean-rooms, ...)
- ❖ Which impacts on the structure of firm knowledge base?

# What's different about nano?

- ❖ Bio : Juxtaposition to / replacement of existing firm KB due to Grilichesian breakthroughs

Premium to Start-ups; Strength of IPR (1 patent=1 market); premium of scientific excellence

Vs.

- ❖ Micro-Nano electronics: hybridization with the existing knowledge base

Premium to large KB, pool of patents, premium to architectural competencies and engineering

# Hypotheses (1)

- Hypothesis 1: The **degree of specialization in nano S&T** decreases with the size of the firm's knowledge base.
- Hypothesis 2: Where nano S&T is developing through hybridisation, **diversity within nano S&T** remains stable when the size of firm's nano knowledge base increases.
- Hypothesis 3: Where **nano S&T is integrated in firm's knowledge base through juxtaposition**, the diversity of the knowledge base within nano S&T increases with the nano knowledge base size.

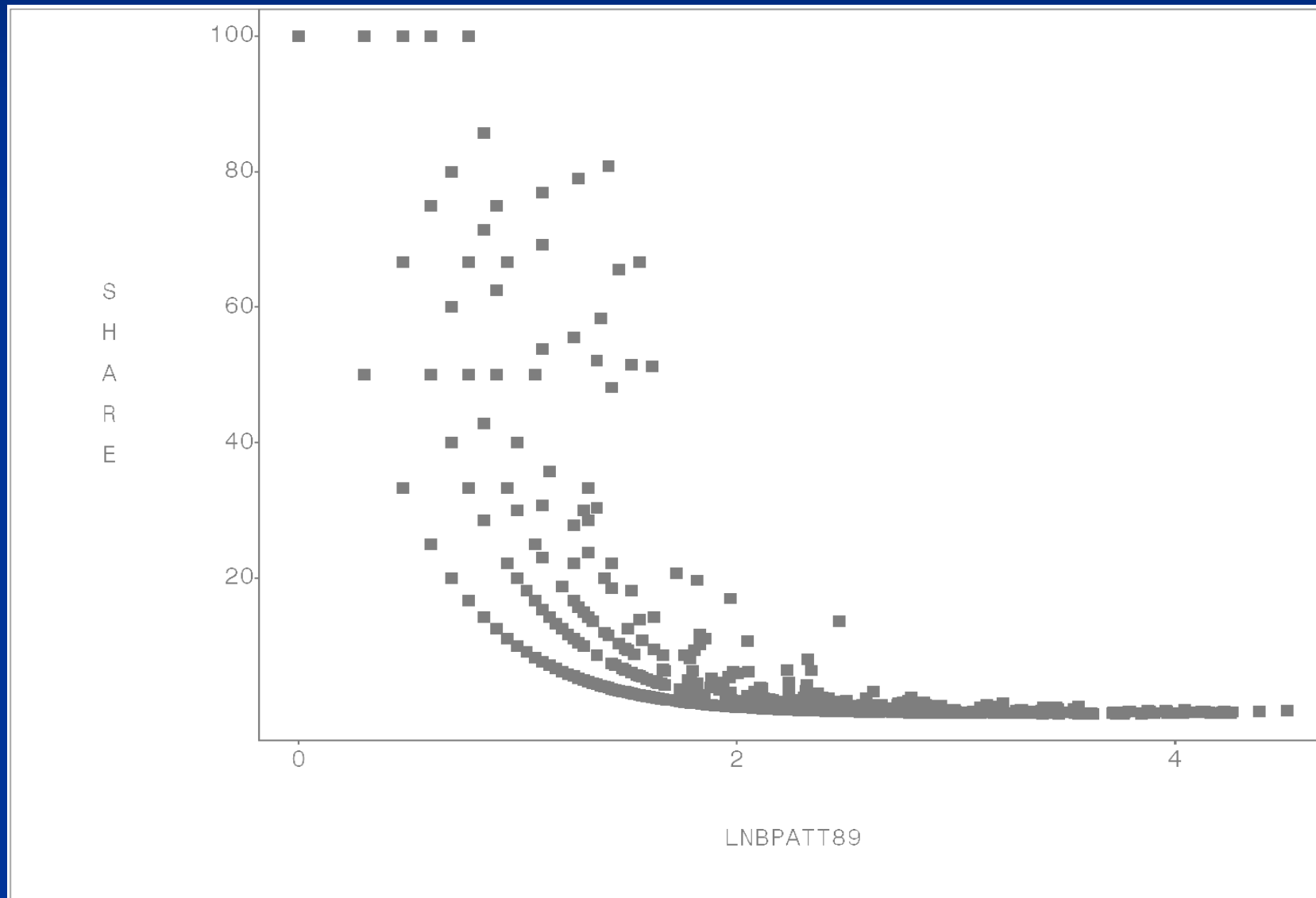
# The database

- ❖ About 3,000 firms involved in nano worldwide for which we have data on:
  - ❖ **publications (1993-2003):** about 15,000 publications
  - ❖ **patents:** about 4,000 US patents
  - ❖ **financial data (1993-2004):** for about 2,000 firms

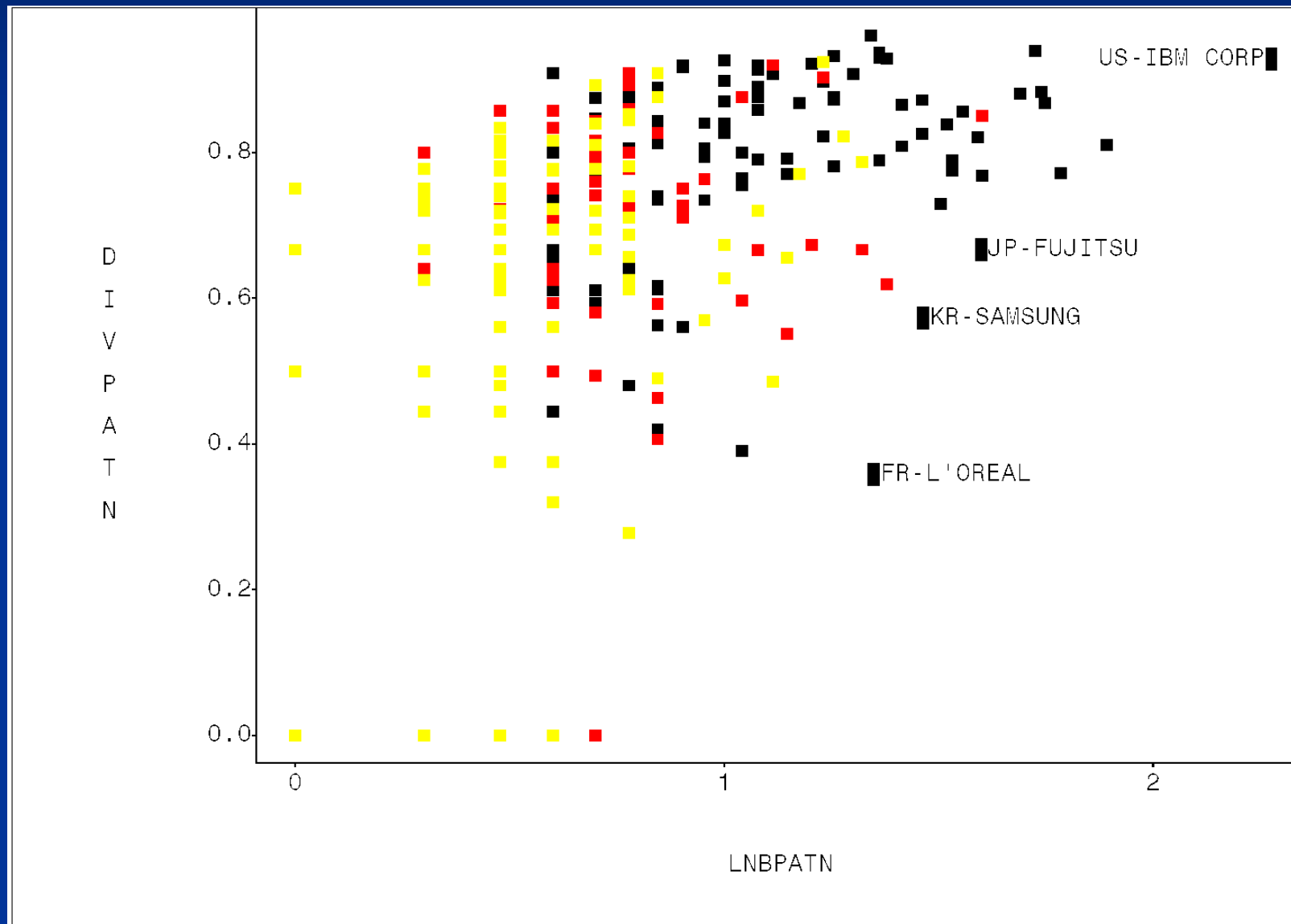
# Variables

	<i>Specialization of firm's knowledge base in nano</i>	<i>Diversity of firm's nano knowledge base</i>	<i>Hybridization within firm's nano knowledge base</i>
Patents	$SHARE = NBPATN89 / NBPATT89$	$DIVPATN = 1 - HHI_{PAT}$	$HYBPATN = FIELDS / NBPATN$
Publications	n.a.	$DIVPUBN = 1 - HHI_{PUB}$	$HYBPUBN = CAT / NBPUBN$

# Specialization and size of the knowledge base



# Diversity and size of nano-knowledge base (patents)





# Where does specialisation in nano come from?

	SHARE
Nber of non nano patent	-8.5677* (-17.56)
Hybridisation	0.8910** (2.08)
Diversity of non nano KB	-30.8383* (-12.94)
Constant	50.2511* (30.28)
R <sup>2</sup>	0.6197
F	454.08
N	839

- Competence destroying and not so transverse
- Hybrid S&T trajectories are emerging
- Grilichesian breakthrough

# Conclusions

- ❖ The most specialized firms are small ones
- ❖ Large firms : addition of new and juxtaposed projects. It will decrease the coherence of the knowledge base of incumbents and it may reduce the propensity to innovate of those firms
  - Collection of independent R&D programs vs. hybridization

# Conclusions (2)

## However

- (1) Existing firms are developing nano S&T linked to their existing knowledge base. It is an extension of the parents' technologies contrary to the biotechnology case in which it radically transforms it
- (2) Access to existing research and production facilities is a key asset in nano S&T as it is built on existing technologies.  
concept of agglomeration of research facilities
- (3) Due to the key role of research facilities, the development of nano S&T and nano firms may be even more geographically polarised to that it has been in biotechnology.

# Implications for public policy (1)

- Coexistence of two types of firms
  - Small, highly (fully) specialized firms
    - Similar to biotech start-ups
    - Diversified
    - Hybrid (process innovation)
  - Large diversified incumbents
- What is the industrial organization of the industry?
  - Which relations between small and large firms ? Division of labor vs. head-to-head competition
  - Which will be the future leaders?
  - Which support for the industry?

# Implications for public policy (2)

- The role of (public) science in nano
  - Presence of small specialized firms suggests a framework similar to bio
    - Creation of firms by scientists
    - Alliances between public labs and firms
  - What is the relation between large incumbents and public research?
    - Knowledge or equipment?

# Implications for public policy (3)

- The geographical dimension
  - What is crucial?
    - Closeness to scientists (star scientists)
    - Availability of large research facilities?
  - Crucial for which type of firms?
    - Strategies of multinationals regarding location of R&D activities: how to attract and maintain them?
    - Creation of dedicated nanotech firms: How to stimulate the process?
    - Interactions between the two?