Intellectual Capital for Communities
in the Knowledge Economy

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Nations, Regions, Cities and Emerging Communities

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How good are VCs at valuing technology? An analysis of patenting and VC investments in nanotechology

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Research questions

We analyze how VC firms evaluate the **patent portfolios** of startup companies in their financing decisions:

✓ *How can IP influence investment decisions of VC investors?*

✓*What importance do they give to different characteristics of patent portfolios (size, technological focus)?*

✓*Do different types of VC vary in their ability to value IP?*

Empirical evidence from a sample of 332 VC-backed companies in the **nanotechnology** sector

EVPAT research project (www.evpat.net)

Research Activities	Diffusion Activities
-Real options and patent valuation - VC financing and patents - IPO and patents - Stock market valuation of patents	- Seminars and workshops - Master in Management of IP - Summer School in Economics and Management of IPRs

The EVPAT (Economic Valuation of Patents) project is financed by the European Investment Bank (EIBURS programme).

VC's criteria to evaluate startups

- ✓ The investment decision of VC firms is largely based on the quality of the entrepreneurial team, the market prospects of the technology, the competitive environment and cash-out potential *(Tyebjee and Bruno,1984; MacMillan et al., 1985)*

- ✓ An attractive IP portfolio can increase the likelihood of investment:
  - *It proves uniqueness of the technology*
  - *It reduces the level of risk*
  - *It can be leveraged to extract value through licensing and technology sale*

Patenting and VC investments

- ✓ Positive relationship between patenting and VC investments *(Kortum and Lerner, 2000; Mann and Sager, 2007)*

- ✓ The breadth of patent protection is significantly associated with higher valuations by VCs *(Lerner, 1994)*

- ✓ The uncertain distribution of IPRs between the university and the academic spin-off can become a particular concern for VCs *(Wright et al., 2006)*

- ✓ A substantial increase in strategic alliances and technology licensing is associated with VC-backed firms *(Hsu, 2006)*

Characteristics of patent portfolios

Not all patents are alike…

✓Patent can differ across several dimensions, which impact on value: age; breadth; family size; number of claims; legal disputes, …

✓We refer to the ***technological focus*** of the patent, referring to its relationship to distinctive technological capabilities of the company

Heterogeneity of VC firms

Not all VC firms are alike…

✓ VC **characteristics** can make a difference regarding the capabilities and the ability to evaluate technology and IP.

✓ We refer to:

- *Degree of Specialization*: Generalist VC firms vs. Industry Specialized VC firms
- *Affiliation*: Independent vs. Corporate VC (CVC)

The context: nanotechnology

1. **Inter-disciplinarity** of nanotech patents
    - *New "Y01N " tag created by the EPO to identify nanotech patent*

2. It is an **optimal setting** to study how VC firms evaluate patent portfolios in their investments:
    - *Several new ventures* have been created in nanotechnology
    - Patents represent an important and effective *mechanism to protect* the returns stemming from nanotech investments

Sample and sources

1. Sample: **332** VC-backed companies in the period 1985-2006
2. Data on VC investments: *VentureXpert*
   - For each company: country, main industries (4 digit), VC investors, founding year, dates of rounds, amount raised for each round
   - For each investor: firm name, affiliation, number of companies in their portfolio
3. Data on patents: *EPO*
   - For each company: all patent applications at the EPO in the field of nanotechnology (9813 in the period 1980-2006)
   - Nanotechnology class is identified through the Y01N code of the ECLEA classification

Dependent and independent variables

Dependent variable	Measure
VC Financing Amount	**Logarithm of the total amount of VC financing (in million US dollars) obtained by the company at the first investment round.**
Independent variable	Measure
Patents	**Stock of patent applications at the European Patent Office at the date of the first financing round.**
Nanotech Patents	**Stock of patent applications at the EPO in the nanotech class (Y01N code of the ECLEA classification).**
Patent Scope (Average breadth)	**Average of the count of the number of IPC classes to which patent examiners assigned each nanotech patent (first 4-IPC digits).**
Specialized VC	**Dummy taking value 1 if the company was financed by a lead VC firm specialized in nanotechnology, and 0 otherwise.**
Corporate VC	**Dummy taking value 1 if the company was financed by a Corporate VC firm, and 0 otherwise.**

Control variables

Control variable	Measure
Company Age	**Difference between the investment year and the foundation year of the company**
Market Scope	**Count of different industries to which the company is assigned by Venture Economics.**
Dummy US	**Dummy taking value 1 for companies located in the United Staes, and 0 otherwise.**
Dummy Early VC	**Dummy taking value 1 for investments in the seed or startup stages of development, and 0 otherwise.**

Descriptive statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Log VC financing (mil US $)	332	0.750189	1.47175	-3.21888	4.714562
Patents	332	0.843374	1.975572	0	15
Nanotech Patents	332	0.207831	0.801546	0	7
Patent Scope	332	0.459759	1.083547	0	7.66
Company Age	332	2.03012	2.708217	0	18
Dummy US	332	0.861446	0.346002	0	1
Market Scope	332	1.64759	0.707679	1	4
Dummy Early VC	332	0.331325	0.4714	0	1

28% of the companies had at least one patent at initial VC financing (10% for nanotech patents)

→ Such figures are higher than those reported by Mann and Sager (2007) for a sample of biotech and software start-ups

Method

We analyzed the relationship between patent portfolios' characteristics of start-up companies and total amount of VC financing in a **OLS regression**

- *Full* sample
- Split sample: *specialized* vs. *generalist* VC firms
- Split sample: *Independent* vs. *Corporate* VC firms

Regression analysis

Variable	Full sample	Specialized VC	Unspecialized VC	Corporate VC	Independent VC
Patents	**n. s.**	**n. s.**	**---**	**n. s.**	**n. s.**
Nanotech Patents	**+++**	**+++**	**n. s.**	**++**	**++**
Patent Scope	**n. s.**	**n. s.**	**+++**	**n. s.**	**n. s.**
Company Age	**n. s.**	**n. s.**	**++**	**++**	**n. s.**
Dummy US	**n. s.**	**n. s.**	**n. s.**	**n. s.**	**n. s.**
Market Scope	**n. s.**	**n. s.**	**n. s.**	**n. s.**	**n. s.**
Dummy Early VC	**---**	**---**	**n. s.**	**---**	**---**
Constant	**+++**	**+++**	**n. s.**	**+**	**++**

Results

1. The amount of financing obtained by the new venture …
   - is *not affected* by the simple ***number of patent applications***
   - But *it is positively affected* by the startup's stock of patents belonging to the ***nanotechnology*** class

The *technological focus* of patent portfolio matters in the VCs' financing decision

2. ***VC specialization*** provides a better understanding of the ventures' context

Specialized VCs tend to value more the *technological focus* of patent portfolios as compared to unspecialized VCs

3. ***VC Affiliation*** does not make a difference in our analyses

CVCs retain an evaluation advantage only if they possess a sufficient *absorptive capacity*, in terms of previous technological knowledge stock

Implications for entrepreneurs and investors

1. Patents are important to attract VC financing, but their technological focus matters

2. The availability of equity financing for IP based company is influenced by the industry expertise of the VC firm

3. Need to develop more sophisticated competences by VC firms in evaluating patent portfolios.

4. Need to incorporate more advanced (quantitative vs. qualitative) methods in the evaluation of startups' patents