Universities as Lead Users

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Our contribution

- Goal: causal analysis of the impact of universities on the innovative performance of suppliers of research material
- performance assessment of the lead user concept
- Focus: provide new evidence for the debate on the economic returns of public investment in basic research
- A set of contributions:
  - universities as lead-users and innovation-related knowledge transfer via the demand channel
  - exploring in depth one specific channel of the relation between firm openness and firm innovation performance
  - causal analysis of universities as lead-users of course correlation is not a causal link
  - alternative database instead of patent citations

Conceptual framework

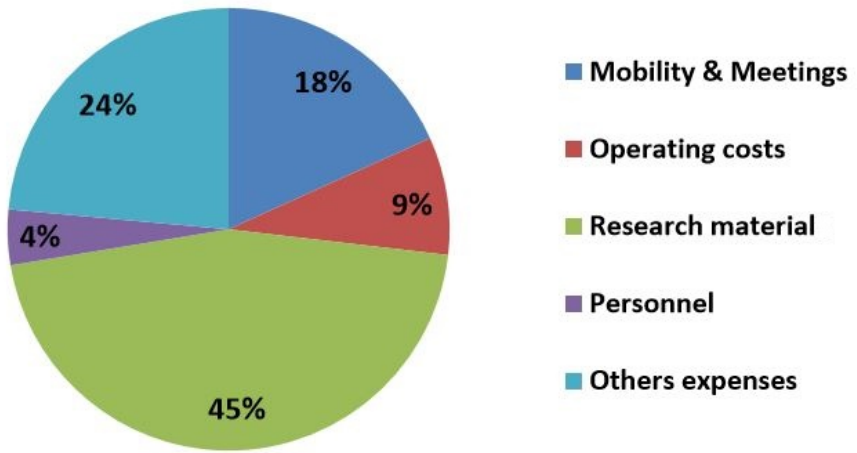
- The discussion of locus of innovation
- The sticky knowledge hypothesis (Von Hippel, 1994)
- An outcome of various characteristics related to the innovation actors and process, not as a cause.
- Deep-rooted features of the piece of knowledge by itself Polanyi (1962)
- The importance of learning processes by which knowledge is derived and stress its contextual features.
- The contribution of academic researchers as users to the development of new scientific instruments and materials
- Three main reasons, which drive researchers to develop new methodologies and scientific material:
  - (i) to broaden the domain of observation
  - (ii) to test existing theories
  - (iii) to carry out large-scale studies
- **University researchers can act as lead-users and have a positive impact on the innovative capacity of their suppliers (?)**

The data

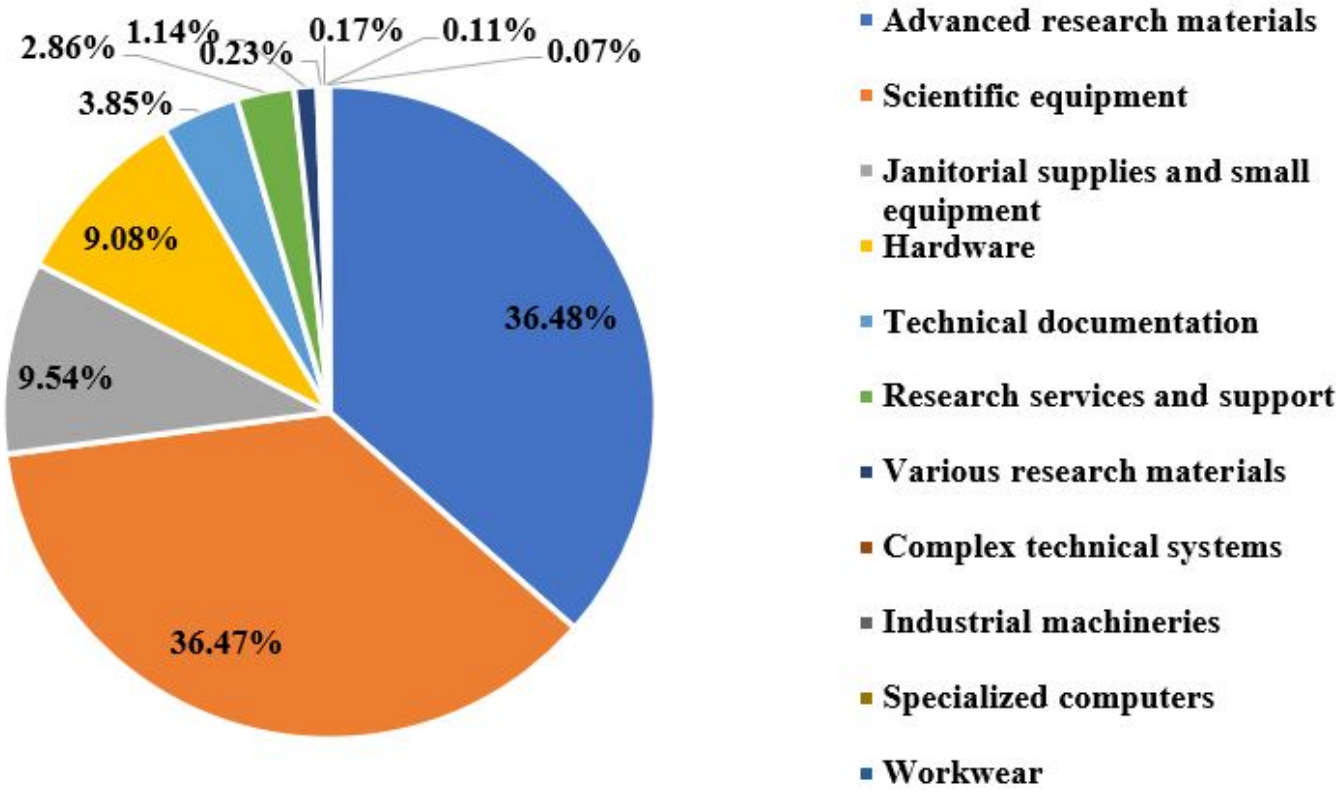
- Fine-grained data on university expenditures and on their suppliers (Source: ASTRAL Project)
- Data at the project-level come from administrative records and financial reports (University of Strasbourg), and contain detailed information on each single economic transaction:
  - nature of the transaction, the amount, the associated supplier, its geographical location, etc.
  - info about the object purchased (i.e. scientific material vs. coffee machine)
- Administrative data are matched with CIS 2012 (Community Innovation Survey) database

Description of the data

- Structured in five categories:
  - 1. Mobility and meetings
  - 2. Operating costs
  - 3. Research materials
  - 4. Personnel
  - 5. Others expenses



Research material



An illustrative example

Table: Purchases in all the rubrics/scientific material/scientific equipment

Object	Amount
Serveur Haute performance	7,708.46 €
Fournitures Bureautiques	463.35 €
Maintenance Lasers	20,542.52 €
Developpemnt Web site	19,734.00 €
Base de données quotidiennes européennes	14,352.00 €
Travaux de peinture UDS	12,012.65 €
Reactifs de detection de biomolecules	37,229.45 €
Reactif de sequencage d'ADN	10,813.20 €
Panneau solaire	5,592.00 €
Anticoprs	5,032.80 €
Mini-protean short plates	3,948.86 €
Azote Liquide	3,246.18 €
Microscope Double Faisceaux	1,060,074.60 €
Logiciel de partage d'images	177,647.86 €
Laser Femtoseconde	115,000.00 €
Agitateur magnétique multipostes	1,770.08 €

An empirical framework

- Quasi-experimental framework
- Treatment is not randomly assigned
- Source of the selection bias:
  - university picks "the best"
  - firm's self-selection
  - Rosenbaum and Rubin (1983) suggest the use of balancing scores b(X)
- Propensity score associated with the treatment via the estimation of a probit model containing all the relevant variables
- Use the estimated propensity score to match the subsample of suppliers with the most similar group of firms that did not become suppliers
- Average Treatment Effect (ATT) is finally computed to draw conclusions

Matching ASTRAL and CIS data

Treatment	# U Suppliers	# Matched	% Sample	% Volume
U suppliers	2975	201	6.76%	23.43
Research materials	1248	145	11.62%	43.18
Scientific materials[1]	923	107	11.59%	52.78
Scientific equipment	240	35	14.58%	67.17

[1] Including scientific equipment

Variables

MAIN VARIABLES	DESCRIPTION
RDI	R&D intensity (R&D expenditure over turnover)
NEWMKT	Product innovations (goods or services) new to the market (dummy)
NEWFRM	Product innovations (goods or services) only new to the firm (dummy)
PAT	Patents filling (dummy)
IPROC	Implementation of a new production process (dummy)
CONTROLS	**DESCRIPTION**
TURNOV	Turnover in 2010
RRDIN	R&D laboratory within the firm (dummy)
COOP	Cooperation with universities or other higher education institutions in firm's country (dummy)
MHT	Medium and high-tech in manufacturing
KIS	Knowledge intensive sector

Descriptive Statistics

Variables	All Firms		U suppliers		Others		T Stat
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
RDI	4.4711	11.386	7.2954	0.1705	4.4346	11.2913	2.4848**
NEWMKT	0.6999	0.458	0.8518	0.3574	0.6976	0.4593	3.0079**
NEWFRM	0.6990	0.458	0.8271	0.3804	0.697	0.4595	2.5346**
PAT	0.2378	0.425	0.3636	0.4834	0.2362	0.4247	2.9594**
IPROC	0.0508	0.219	0.1506	0.3587	0.0499	0.2178	2.9372**
TURNOV	0.0845	0.825	1.0287	5.0788	0.0755	0.6611	14.8975***
RRDIN	0.7135	0.452	0.8181	0.3876	0.7122	0.4527	2.3173**
COOP	0.2714	0.445	0.5483	0.5017	0.2657	0.008	4.9725**
MHT	0.1159	0.320	0.165	0.372	0.1155	0.319	2.1758**
KIS	0.1189	0.323	0.165	0.372	0.1185	0.323	2.0190**
OBS	22 162		200		21 962		

Variables	T1 (supplier) (1)	(2)	T2 (research material) (3)	(4)	T3 (scientific material) (5)	(6)
TURNOV	0.0784***	0.6450***	0.0616***	0.0501***	0.0079	-0.0062
	(0.0146)	(0.0151)	(0.0143)	(0.0149)	(0.0336)	(0.0427)
RRDIN	0.1609	-0.1261	0.0940	-0.1339	0.2125	0.0820
	(0.0998)	(0.1632)	(0.1090)	(0.1816)	(0.1358)	(0.0820)
MHT	0.1325	0.0037	0.2379**	0.1355	0.3236**	0.3036*
	(0.0992)	(0.1369)	(0.1038)	(0.1443)	(0.1113)	(0.1601)
KIS	0.1391	0.2191	-0.10244	0.042	-0.4244*	-0.4433
	(0.1058)	(0.1395)	(0.1426)	(0.1754)	(0.2308)	(0.3432)
COOP		0.4425***		0.3605**		0.3517*
		(0.1157)		(0.1311)		(0.1579)
CONSTANT	-2.4388	-2.1972	-2.492	-2.2932	-2.7041	-2.6659
	(0.0878)	(0.1452)	(0.0942)	(0.1612)	(0.1210)	(0.2425)
Obs	7764	3094	7764	3094	7764	3094
Pseudo R2	0.0359	0.0712	0.0305	0.0496	0.0344	0.0513
Correctly classified	97%	98%	99.07%	98.64%	99.36%	99.19%

[2]We are extending with other variables stemming from another database (balance-sheet variables such as financial constraints, labour productivity, etc.

Treatment 1: All suppliers

	(1)			(2)		
Variables	Treated	Controls	Difference	Treated	Controls	Difference
RDI	8.21	3.89	4.32**	10.69	5.98	4.71*
NEWMKT	0.85	0.69	0.16***	0.87	0.76	0.11*
NEWFRM	0.83	0.73	0.10**	0.84	0.76	0.07
PAT	0.39	0.42	-0.03	0.53	0.53	0.00
IPROC	0.26	0.25	0.02	0.31	0.25	0.06

Treatment 2: Suppliers in research material

	(1)			(2)		
Variables	Treated	Controls	Difference	Treated	Controls	Difference
RDI	6.73	3.21	3.51*	8.79	5.22	3.58
NEWMKT	0.85	0.69	0.16***	0.89	0.79	0.11*
NEWFRM	0.82	0.74	0.08	0.85	0.69	0.15**
PAT	0.35	0.41	-0.06	0.49	0.56	-0.06
IPROC	0.27	0.23	0.066	0.33	0.25	0.08

Treatment 3: Suppliers in research material

	(1)			(2)		
Variables	Treated	Controls	Difference	Treated	Controls	Difference
RDI	5.75	3.70	2.06	5.31	6.39	-1.08
NEWMKT	0.88	0.65	0.23***	1.00	0.74	0.26***
NEWFRM	0.84	0.76	0.08	0.87	0.73	0.14*
PAT	0.35	0.44	-0.09	0.57	0.61	-0.28
IPROC	0.21	0.20	0.00	0.26	0.18	0.09

Conclusions

- Analysis of the effect of users on firms' innovative performance
- University suppliers have higher propensity to introduce new-to-the-market product innovations
- Empirical analysis in a quasi-experimental framework
  - static analysis
- Agenda
  - final goal: establish causal in a dynamic setting establish causal relation between users contributions and firms innovation
  - difference in difference matching
  - add data for second period
  - assess how innovative behaviour of firms changes overs time in two periods

Implications

- In terms of public policy, can we consider universities as "industrial policy instrument"?

Next

- Survey - Multiple case studies
- Case study IRCAD (Institut de recherche contre les cancers de l'appareil digestif)