Industrial Funding Path Analysis in the Italian University System

Mariafebronia Sciacca

University of Turin, C.so Unione Sovietica 218/bis, 10134 Turin, Italy
Sciacca@econ.unito.it

Abstract. This article attempts to describe recent paths in University-Industry linkages in the Italian University system. In the last decades University vision has fundamentally changed together with its structure and goals. A large debate has raised towards and main findings have been shared around several aspects that are impossible to be adequately covered, nevertheless we present an outlook of the general trends and literature. One of the most challenging development of University has been the mass education expansion (Trow, 1973), and the rising number of undergraduates that have stimulated a sensitive growth in number and size of many Universities. In the international frame also institutions differentiation of the overall higher education system has been pointed out as a strategic focus on which the actors will be engaged in the future (Bonaccorsi 2007). Moreover, a large part of the literature has been dedicated to knowledge society (Etzkovitz, 2003) and service market economy, an issue that has incentivized an increasing interaction between University and the external actors, and its "openness" (Slaughter and Leslie, 1997). Beyond the first and the second mission (respectively represented by teaching and research), a third stream of activities has come up as "dissemination or outreach activities" (Gulbrandsen et al. 2007), exploring the degree of entrepreneurship in the current University system (Etzkovitz, 2000). University-industry knowledge transfer represents a key research subject in the economics studies, and a critical issue in science and technology policy agenda of several countries, and inevitably linked to innovation policy, whereas innovation deals not only with specific firms but with a huge field of institutions that aim to develop technological system at national level (Lundvall, 1992).

Such complex framework offers a new vision that shifts from "old University ivory tower system" towards the openness to external actors and the market has raised, even though there is no evidence that all the external interactions between university and environment are market driven (Olsen, 2007). On one hand, new needs come from the market and a growing competition for resources between universities seems to be evident, on the other hand industry is looking for knowledge-intensive fonts, a trend accompanied by a substantial reduction of internal R&D activity.

With regard to the impact of non-public funding, in the University financial data three are the main sources of funds: Students fee, fund-raising and consultancy and contracts. Even though non-public resource is not the most significant and accounts for a small part of entire University budget, nevertheless many changes have occurred in the last years, after declining of public funds.

R.J. Howlett et al. (Eds.): *Innovation through Knowledge Transfer 2012*, SIST 18, pp. 211–226.
DOI: 10.1007/978-3-642-34219-6_24

Large debate has raised questions on motivation for academics to engage with industry, on type of contracts design for industrial collaboration, on the nature of the collaborations and main barriers (Bruneel et al. 2010), on the proximity between Industry and University (Arundel and Geuna, 2004) and joint research collaboration (D'Este et. al, 2010), while few attention has been dedicated to the relation which links Industrial funding, scientific area and quality indicators in the Universities Model in the recent years, with particular reference to Italian system.

1 Changing Strategy – A General Overview

This paper investigates University and Industry recent paths and describe the relations which links Industrial funding towards performance indicators in the Universities Model in the recent years, in the Italian system, that have guided the development of new strategies linked to organization behavior, to new funding paths and to a novel governance. Our results show that a good University performance may facilitate an external collaborations, but definitively it can foster mutual benefit in University-Industry frame of relations.

The next part is organized as follows: we start with the description of the background of research activities and Industrial funds relations in European and Italian frame; we then illustrate the methodology used to collect data in an original dataset and the Research questions; we finally design a description of the main trends of the analysis and finally report the statistic results and the conclusions.

2 Background

2.1 Focus on EU

In most of European countries the reduction of Government funds has raised concerns about the financial stability of Universities in terms of higher education system (Herbst, 2007). Somewhere, it has caused a remarkable raising of student taxation, in some other it has been addressed a sensitive cutting policy in public funds devoted to research. So far, no economy of scale and scope has been demonstrated for Universities. Hence, the growing need of resources has incentivized Universities in capturing new resources. Furthermore, Universities have switched from a centralized model to an autonomous, self-regulated model and many studies have described the "new public management" thinking (Bleiklie, 1994) comparing the university system to a service enterprise embedded (Olsen, 2007). This process has been encouraged by the increasing autonomy, in terms of reallocation of resources and accompanied by necessity to identify an evaluation protocol of their performance. In France and Germany[1] lump sum budgeting trend has permitted a wider discretional use in the resource allocation for Universities. In parallel, the development of an evaluation system has been set up in other

[1] In the Germany case funding of Science were distributed on a competition between public and private (Drittmittel).

countries. This process is generally based on historical input/output model, as for example the UK experience of RAE and REF and other similar practices that have occurred in other countries as France Spain (PNICDT[2]) and Holland[3]. Besides the general trend of evaluation of teaching and research activities that links the funding model to other parameters, there is a third stream of changing rules in the allocation of resources driven from historical–base to performance evaluation, deeply influenced by the decline of Government funds income (Palumbo 1999, Grossman and Helpman 1991, Salmi Hautman 2006). Large part of literature has argued that evaluation and performance parameters could affect reputation and in a certain indirect way Industry funding trends.

2.2 Italian University System

Before going in depth into research details some premises have to be pointed out on structural conditions of Italian system, and its main characteristics, with reference to the decentralization trend and the evaluation process.

First, as happened for European countries Italian universities have registered a significant drop in government funds, estimated in a -5% in 2000-09; the age of Professors is definitely over the EU relative colleagues while the salary is under the EU average; many authors assert that transparency in the selection process is not still guaranteed in the current system, even though decision policy should have broken with traditional system.

Second, looking at the self regulation trend, this process has started in 1989 with law 168, which enhanced autonomy and self-regulation from administrative perspective; further steps towards higher flexibility of local Universities have been made and these change have generated an higher discretional power to attract external funds and have increased University governance autonomy to set rules at local level. On the other hand, although the abovementioned premises, this process has not followed a linear trend in the following years 2000-2010. In fact, further government policies have not been substantially changed the University decisional process with regards to the organizational structure and to the funding management, so that many authors believe that gradual and conservative attitude and typical negotiation style still persist. In particular, the critical leverages of selection procedures and remuneration remained under the control of the government through the Ministry of University and Education (MIUR) (Fini and Grimaldi, 2011). Nevertheless, cut of Government funds has been steady and at the same time differentiated within universities, partially driven by Universities performance (Capano, 2011). From the HEIRD point of view, Bologna process in EHEA edge[4] has introduced a series of innovative aims throughout the last decade, but it had few direct consequences in the funding model (Moscati, 2010).

---

[2] Plan nacional de investigaciòn cientifica y desarrollo tecnològico is a pluriennal plans for the definition of resources addressed to research.

[3] National Counseil of Research in Holland has rivendicated the trend of a funding distribution based on historical data (Nwo).

[4] European Higher Education Area, an initiavite launched in 2010 aims to ensure more comparable, compatible and coherent systems of higher education in Europe.

These legislative drivers together with the development of different external (changing environment) and internal (increasing number of students) have caused the revision of a University strategy and on the other side a different approach towards the attractiveness of new external sources of funding. For this reason, in our model we consider the evaluation process as one of the significant variable that link government and industrial funding.

Thus, although some attention has been devoted to private participation in the university funding issue from literature, and the main findings are that Industry funding are characterized by an high level of competition and by a continuous short-term evaluation of research outputs; Industry funding tends to be funneled towards top universities; subsidy model has changed at the European level (Geuna 2001), few attention has been dedicated to the relation which links Industrial funding, scientific area and quality indicators in the Universities Model in the recent years, with particular reference to Italian system.

The scope of this study is to relate industrial funds and users that generate and manage U-I relations, and looking at the historical development of these connections.

We associate Industry funding and performance of Universities on a panel data representing the quasi-totality of the Italian Universities. We base the analysis starting from the assumptions derived by the literature with the integration other intuitions coming from empirical analysis with some caveats.

First of all, through the definition of efficiency as the capability to make the best use of input in order to generate the best outputs, in other words making reference to the technical efficiency, which relies on how resources are employed in a non-market system as University is (Bonaccorsi et al., 2007).

Secondly, beyond the innovative approach we focus on research inputs and outputs, consequently our indexes include also physical parameters as composition of staff, presence of scholarships and PhD over graduates. Universities have a multi-inputs and multi-outputs production (Bonaccorsi, 2007), a caveat is represented by the fact that studying such a complex frame is clearly difficult but it is not the aim of this work, moreover we are interested in providing a frame on U-I relations trend. Thirdly, studying industrial funding as mentioned above is equal to analyze a small subset of the entire budget, for this reason we undertake some statistical methods to adequately represent also small numbers. Fourthly, we exploited different control variables as size, geography and type of education to assess and clarify the influence of fixed effects on the regression variables.

3 Methods

In this paragraph, we illustrate the approach and the methodology employed to define the empirical models. We primarily collected financial and qualitative data in an original dataset and gathered information through three different approaches. First we refer to MIUR database for the financial data; then we gathered data from Nuclei Miur Evaluation; thirdly we adopted PRO3 Cineca performance indexes according to the Institutional perspective and aims.

We observed variables on a panel data collected from 2006 to 2009 due to several reasons. Since all financial data have been significantly transformed from 2006 on, and few comparability and feasibility could be assigned to previous data we decided to exclude the years before. Second, since the availability of 2010 data is partial and performance evaluation is partially covered, we dropped 2010 observations. Thirdly, the aim of this research is to consider a balanced sample including the same universities along the mentioned period.

Our approach consisted initially in the collection of a sample of 75 Italian universities. We have cleared all Universities reporting an high range of missing values in the financial data, and we finally obtained a sample of 69 Universities. Two universities have been finally dropped from regression since they presented only zero value in industrial indicators, probably due to incoherent data classification. We have referred to Nuclei MIUR Cineca dataset[5] to be able to identify on one hand economic data linked to scientific research, and on the other hand to obtain the department level data, that let us distinguish scientific and non scientific area. Finally, we have merged these information with other performance indicators partly built by an institutional program for establishment of the University aims (Pro3[6]), and party inspired by the literature[7].

Then, we have investigate the distribution and the best performing Universities throughout indexes originated in order to recognize degree of autonomy and attractiveness for Universities. The analysis is consequently based on performance indicators, aiming to describe attractiveness through panel data will be shown at University level. The last part of the analysis is focused on the relations between evaluation indexes and other financial indicators. Time lag for the model estimation which takes into consideration VTR ranking scores is due to the publication of these indexes, which took place with a three years lag; thus evaluation of 2001-03, published in 2006 has been assumed as having its effect in years 2006-2007 and in the long run in 2008 (M5).

H1) Is the degree of autonomy associated to higher efficiency? Is the industrial funding linked to efficiency or international relations?

We assume degree of autonomy as the ratio of non government funds over total income in research. In this ratio are not only counted private subjects but also other public parties different from government. We also repeat the estimation considering private funds, but as dependent variable we put both performance measured as professor over total income and degree of international attractiveness (both indexes are inspired and partially changes to evaluation process driven by MIUR[8]).

[5] Online reference is Nuclei.miur.it/sommario, the data enclose different set of information grouped by fareas.

[6] Programmazione-triennale.cineca.it, Pro3 is a program of data collection launched by MIUR in collaboration with CINECA consortium (Art. 1-ter of Legislative Decree 31 January 2005, No. 7, into law March 31, 2005, n.43), and has oriented the definition of the pluriennal aims of Italian universities based on qualitative and quantitative data.

[7] See Bonaccorsi et al. 2007 for a more detailed description.

[8] See note 7.

H2) Is Government funding decline a determinant in to industry funding?

The rationale here is to estimate the variation of government funds respect to the variation of industrial funds. We expect a different degree in the universities, due to different extent of collaboration. In this frame the best case should react more to a decrease of public funds. Size could affect substantially all these variation . We also control the incidence of size, north and type of University.

H3) Are Research oriented Universities performing better in terms of funding attractiveness?

In the assessed model we try to input research orientation measured as the average of several inputs. This index includes Number of PhD Scholarship financed by external funds over the total Number of scholarship; Number of Scholarship per Doctoral course, Economic availability per professor. The higher the score is, the more Research oriented the university are.

H4) Is quality evaluation relevant for Industrial attractiveness?

Last research question concerns the quality evaluation index VTR[9] developed by MIUR in the 2001-2003. In our frame, it represents a control variable, able to extend all previous question research, taking into account a possible ranking of Universities. This approach presents some caveats. First of all, time lag could be seen as a limit of research, but in our assumption since this data have been published in 2006, they could determine some influences from this year on, that corresponds to our time analysis. Second, even though there is a single quality index per University, we suppose that University ranking is not volatile and its effect persist for a certain period. This is also supported by the fact of a complex evaluation as VTR has consisted in.

4 Definition of Variables

As mentioned above, we assume the degree of autonomy as a the share of non government funds over total income for research, while Industrial funds over total income from research activities is the dependent variable, and aims to measure the degree of private funds.

Several statistics concerns have raised over this subject due to multidimensionality, presence of outliers. In our study we mitigate scale-effect measuring each component on the total income deriving from research activities, and look for a correlation between the decreasing of Government funds and industrial paths; we also look at other sources of funds as International contracts, no-profit funds.

[9] VTR 2006 (Valutazione Triennale della Ricerca) is an evaluation process carried out and managed by the Committee for Research Evaluation (CIVR), art. 5 Legislative Decree no. 204 on June 5th, 1998 and following modifications and integrations. It is organized in areas courresponding to 14 scientific-disciplinary Area of the National University Committee (CUN). For a detailed description see: `http://vtr2006.cineca.it/documenti/DM2206_EN.pdf`

We expand the relation with industrial funds considering also structural and physical variables of each university (H1 e H2), to understand the determinants that foster the collaboration with reference to a greater degree of autonomy and Government decrease. In H3 we adopt variables that may represent research orientation of the university and in H4 we add performance and quality indicators to universities and in a nested model to scientific Departments only.

Then, we try to consider only scientific area to see if estimation improve. Independent variables are performance indexes built on staff engagement, research orientation and on the other side Government funds decrease. In all the model we adopt analysis of variance to test the robustness of our models. A set of control variables have been used to limit some university-fixed effects.

Size

The foundation is to control the great variability that could affect the model: size has been calculated by using the Institutional classification of MIUR, set by the Number of students (both undergraduate and graduate), resulted in four classes (micro, mini, medium, mega). Our rationale behind this hypothesis is a better performance in the center classes, since in the mega class we expect a dispersion of economies of scale and in the smallest we do not expect economies of scale.

Type of University

In the Italian system four classes have been identified: Public, Private, Advance School of Doctorate and University for Foreign studies. In our data sample we considered the total of Public Universities and excluded some of private and University of Foreign studies due to missing data. With regards to this hypothesis we aim to understand whether private and Advanced School of Doctorate could better perform in industrial relations.

Polytechnic

The polytechnic Universities have been identified as a dummy variable and we expect that it might likely to set up an higher extent of technology skills towards industry. For this reason a polytechnic is more reliant to collaborate with firms, even its typical small size.

Geography

Most of literature suggest a slight variance across regions (Baldini , Grimaldi). Even this is not the aim of this paper we also take into consideration North as a dummy variable to define the extent of its effects.

General University

Defining general university versus specialized universities means distinguish universities offering both scientific and non scientific knowledge. Consequently in research activities from those that have 1 to 5 departments focused on specific matters (both only scientific or only humanities). In our analysis we aim to demonstrate an higher performance in those institutions specialized in scientific field. This variable is controlled as a dummy variable.

The last three control variables are looking at the knowledge orientation of University in different ways, but complementarily.

Scientific Sector Productivity
In the examination of potential influence of scientific sector, we took into account only scientific department (corresponding to Area 1-9 of the Italian system) and control for the assigned rating for each area. The rating has been provided by VTR2006[10] and it encloses several variables as for example the number of researchers, an evaluation of some research products, the international mobility of personnel, patents, spin-off and so on). Thanks to this synthetic scoring we look at the measure of a possible attractiveness of the university in terms of industrial funding. For this aim we have collected 1.236 departments, secondly we have clustered them into the 9 scientific area and assigned an average rating per area per University.

Table 1

Universities - Descriptive Statistics

Year	Frequency	Polytechnic	Non Polytechnic	Public	Private	Advanced School	Foreigners	Specialized Institutions	General studies
2006	69	4	65	58	6	3	2	15	54
2007	69	4	65	58	6	3	2	15	54
2008	69	4	65	58	6	3	2	15	54
2009	69	4	65	58	6	3	2	15	54
Total	**276**	**16**	**260**	**232**	**24**	**12**	**8**	**60**	**216**

As shown in table 1, sample composition of our data is balanced and all observations are equal per year.

Table 2

Variable	*Scale*	*Source*	*Measure*
DA	Continuous	NUCLEI MIUR	Degree of Autonomy
PROF	Discrete	PRO3	N° of Professor and researchers
EXT_PHD	Continuous	PRO3	N° of PhD Scholarship financed by external subjects
IF	Continuous	NUCLEI MIUR	Industrial funding
INT	Continuous	PRO3	International contracts and agreements
OTHER	Continuous	NUCLEI MIUR	Other income from
TER	Continuous	NUCLEI MIUR	Total Budget for Research
QUAL	Continuous	VTR CINECA	Quality index set by VTR

5 Empirical Analysis

In order to carry out the analysis, some new variables have been developed to mitigate the scale effects and to better represent structural university

[10] See also www.cnvsu.it

characteristics. We have adopted for estimation a regression model, supplemented by other estimations including control variables.

$$\frac{DA}{TER} = \alpha + \beta_1 \frac{PROF}{TER} \quad (M1A)$$

$$\frac{IF}{TER} = \alpha + \beta_1 \frac{PROF}{TER} + \frac{INT}{TER} \quad (M1B)$$

$$\frac{IF}{TER} = \alpha + \beta_1 \frac{GOV}{TER} + SIZE + NORTH + GENER + POLI \quad (M2)$$

$$IF_{OTHERPROF} = \alpha + \beta_1 \frac{ECO}{PROF} + SIZE + NORTH + GENER + POLI \quad (M3)$$

$$\frac{IF_{OTHER}}{TER} = \alpha + \beta_1 \frac{MIUR}{TER} + BTOT + SIZE + GEOG + TYPE + POLI \quad (M4)$$

$$IF = \alpha + \beta_1 QUAL \quad (M5)$$

From the observed results, we can note how total budget of research (TER) varies in function of size, staff and total expenses and in a general perspectives it grows in the selected period. Nevertheless there are consistent differences in the composition of Income for research activities. Descriptive shows a slight decline of private source in 2007, that significantly change its trends in the following years, while only Government funds decrease constantly over years.

Further, the distribution of all sources of funding is subjected to a great variability. Contracts with international private actors are constantly increased over the selected period, as well as resources from projects funded by European Union.

Table 3

YEARS/VALUE (K€)	ENTERP_	Delta	EU_	Delta	MINIST_	Delta	OTHER	Delta	Total ext_ resources	Delta
2006	52.375		118.637		244.187		363.128		769.636	
2007	48.977	-6%	158.192	33%	214.992	-12%	318.301	-12%	863.549	12%
2008	52.278	7%	111.711	-29%	161.340	-25%	320.730	1%	744.075	-14%
2009	57.180	9%	181.355	62%	155.585	-4%	418.366	30%	1.017.936	37%
AVERAG	52.703		142.474		194.026		355.131		848.799	
STAND_DEV_	3.377,1		33.032,1		42.824,4		46.913,0		123.906,9	

Funding distribution by year and source

Beyond the general funding distribution, if we consider indexes based on research activity input (as number of Professors and researchers, or number of PhD programs), it is of great interest to note that the variation in economic capacity per professor, inversely related to the size of the universities, but with significant exceptions that could be found in the top University table. This aspect could be associated to an higher efficiency of small structures, or alternatively, a

structural barrier for structured behavior in the large universities. Literature does not report specific relationships between size (in terms of Number of staff) and efficiency, but limits its considerations to particular scientific sectors.

Table 4

(Average values)				
Size	N° Prof	N° PhD Program	Expenses tot for research (k€)	Economic capacity per Prof.
Micro	177,1	8,5	4.490,6	32,4
Small	569,8	19,1	8.023,8	14,2
Medium	1.034,3	38,2	18.269,2	18,3
Macro	2.502,5	86,2	40.110,8	16,6

Funding resources and staff by size

Table 5

TOP FIVE	ENTERP_	TOP FIVE AS % OF TOT	TOP FIVE	OTHER INCOME	TOP FIVE AS % OF TOT
2006	**52.375**	**52%**	**2006**	**363.128**	**35%**
MILANO	13.618		Scuola Normale Superiore di PISA	39.983	
POLITECNICO TORINO	5.479		ROMA "La Sapienza"	31.631	
ROMA "Tor Vergata"	2.892		GENOVA	21.150	
FIRENZE	2.750		POLITECNICO MILANO	17.878	
BOLOGNA	2.631		BOLOGNA	17.129	
2007	**48.977**	**42%**	**2007**	**318.301**	**32%**
MILANO	7.840		ROMA "La Sapienza"	29.606	
POLITECNICO TORINO	4.282		POLITECNICO MILANO	22.469	
FIRENZE	3.445		GENOVA	18.237	
BOLOGNA	3.034		BOLOGNA	16.380	
POLITECNICO MILANO	1.876		PADOVA	15.779	
2008	**52.278**	**40%**	**2008**	**320.730**	**31%**
MILANO	8.635		POLITECNICO MILANO	22.470	
POLITECNICO TORINO	5.956		ROMA "La Sapienza"	21.005	
FIRENZE	2.530		GENOVA	19.486	
POLITECNICO MILANO	1.948		BOLOGNA	18.321	
VERONA	1.703		NAPOLI "Federico II"	17.991	
2009	**57.180**	**28%**	**2009**	**418.366**	**32%**
VERONA	5.226		POLITECNICO MILANO	34.638	
FIRENZE	3.788		ROMA "La Sapienza"	32.418	
POLITECNICO MILANO	2.807		BOLOGNA	25.415	
TORINO	2.196		NAPOLI "Federico II"	20.472	
SIENA	2.072		GENOVA	19.503	

Top Universities by private funds and other income (contracts, consultancy etc.)

Table 5 presents the best performing Universities per year and per source of funding. Top five universities represent a good percentage of the total in 2006 while in the following years private funding has definitively raised and more diluted over several universities. Another interesting (and largely investigated) facet is that almost all top Universities are from North Italy. According to literature this is coherent with other performances in third mission activities, and also in the case of private funds it is probably linked to entrepreneurial environment particular developed in regions as Lombardia, Emilia Romagna and Piedmont.

Consequently, we have controlled regression models for size and geography. In both columns it is straightforward that top universities do not change their positions across years.

In order to capture the average income deriving from industry we present a table with these values split by the more significant structural characteristic of Universities. In particular, in Table 6, we note a positive increasing of general institutions, versus an inverse trend in specialized institutions (all those Universities which limit their activity to a restricted range of topics).

Table 6

	Average Value (K€)									
Year	General studies	Specializ	Polytechnic	Public	Advanced Schools of Doct.	Private	Micro	Small	Medium	Mega
2006	807,7	673,6	1.910,3	883,8	69,7	151,2	151,3	356,3	859,8	2.458,9
2007	767,5	592,9	1.723,8	820,2	9,7	229,5	160,9	372,8	965,3	1.931,8
2008	795,2	723,9	2.179,0	876,9	19,7	226,0	204,3	445,3	1.097,9	1.812,0
2009	912,7	629,2	1.151,5	914,6	231,3	573,5	360,0	667,5	1.127,9	1.549,7

Average income from industry per University

As argued before, the trend suggests that leads University in exploiting also different area, while on the other hand, Polytechnics show a slight but constant decline in attracting these resources, while Private Universities and Advanced Schools of Doctorate represent a really interesting case to be further investigated.

As argued by Turri (2011) Advance Schools of Doctorate have interpreted better than others the “corporate model” described by Olsen (2007), partly due to their organization and their market driven attitude, there are able to attract several resources, and thanks to their small dimension and limited number of staff.

6 Results and Discussion

The results of the five models are presented in table 8. The estimation results include a Beta coefficient slight negative for the first two hypothesis and in case of Model 1b not significant. In fact, degree of autonomy and Industrial funds do not rely positively with professor efficiency and are not significant with international contracts.

Table 7

			Confidence interval 95%		
Variable	St. Dev	Mean	Inf	Sup	Sig.
DA/TER	0,46	0,60	0,55	0,66	0,00
PROF/TER	0,05	0,06	0,06	0,07	0,00
IF/TER	0,06	0,05	0,04	0,05	0,00
GOV/TER	0,10	0,15	0,14	0,17	0,00
IF_OTHER/PROF	26,68	8,80	5,59	12,00	0,00
ECO/PROF	0,02	0,01	0,01	0,01	0,00
IF_OTHER/TER	0,43	0,32	0,26	0,37	0,00
PERF	0,05	0,03	0,03	0,04	0,00

Descriptive statistics

Table 8

	Model estimation					
	1	***1B***	***2***	***3***	***4***	***5***
PROF /TER	-,160 (0,546)***	-0,73(0,077)				
INT/TER		-0,19 (0,038)				
Gov/TER			-,122 (0,040)*		0,226 (0,269)***	
ECO/PROF				0,221(103,7)***		
BTOT					0,166 (0,500) ***	
VTR 2008						0,085 (64,7)**
VTR 2007						0,073 (35,07)**
VTR 2006						0,075 (41,23)**
Size 1			-0,123 (0,040)	0,195 (105,3)**	0,228 / 0,160 **	
Size 2			-0,124 (0,040)*	0,215 (104,8)**	0,226 / 0,168 **	
Size 3			-0,121 (0,040)	0,219 (104,6)**	0,227 / 0,164 **	
Size 4			-0,120 (0,040)	0,223 (103,8)**	0,227 / 0,164 **	
North			-0,123 (0,041)**	0,228 (104,7)**	0,234 / 0,165 **	
Generl			-0,118 (0,040)	0,178 (106,4)**	0,230 / 0,145 **	
Poli			-0,077 (0,040)**	0,220 (104,8) **	0,233 / 0,170 **	

****p-value < 0,01 (2-tails) **p-value < 0,05 (2-tails) *p-value < 0,1 (2-tails).*

Beta(std error)

Regression results

Secondly, Government fund distribution is negatively associated to Industrial funds, and the relations support our hypothesis of a fostering other external collaborations. We also observe a good deal with "North" dummy variable that do improve the model.

One of most significant results from the third model is the positive correlation between Economic availability of Professors and their effective attractiveness of industrial funds and other contracts. It seems that research oriented Universities are likely to perform better in acquiring new resources from private investors. We controlled the model for different variables and according to literature North dummy increase the robustness of the model. We also noted that mega University (size >40.000 students) and Polytechnic are slight sensitive to these collaborations. Switching to relation to overall performance including the structure employed for research, personnel dedicated and PhD scholarship we note an positive and associable relations with industrial funds. University with a better performance index tend to attract a huge amount of resource. The model is significant for all controlling variables.

We finally consider if quality evaluation is relevant with Industrial attractiveness and set the ranking score of scientific departments for all university included in the sample, we then examine relations between ranking score and industry funding to relative department. The result is significant and positive for all the three years considered (2006-08), while 2009 has been excluded for diluted time effects. Our conclusion is that industry funds are in a positive relation in the Models 3 4 and 5 and even though private source is a small component of entire budget, nevertheless it is affected by performance indexes and in particular ranking scores. These indexes can be considered as a proxy for internal organization of the University and are related to the external capacity of attractiveness.

On the other side, limiting the analysis to some sources of funds (Government, professor/economic resources) only we do not find a significant relation and in certain cases we have a slight negative results, probably due to the incompleteness of the built indexes.

7 Conclusions

From industry viewpoint, University represents a big resource of knowledge that can improve an existing product or capability (Bercovitz Feldman 2006). Many empirical researches can demonstrate it. Feller et al. (2002) reported that 63% of the companies participating at Engineering Research Centers (ERCs) have received direct technical assistance from university researches. Geuna (1999) and Mowery et. Al. (2001) underline that university has long served as a source of foundation scientific and technical knowledge; however the discovery of breakthroughs with significant commercial potential such as biotechnology, computer science, material science and nanotechnology is driving increased industry sponsorship of university research. The research type, university-industry interactions may differ in terms of level of ongoing involvement. A firm's R&D alliances with universities may involve either single transactions such as

individual projects or in-depth long-term relationships as another part of R&D strategy (Berkovitz and Feldman 2006). In particular, among the several alliances that firm can carry on, universities are preferred partners when there are concerns about the perceived ability to fully appropriate the results, for those projects that engage a long-term and risky strategy. The difference between firm and university can provide a unique incentive, because the partner feature (public) can prevent the actor to act opportunistically, for example including the right of first refusal to license IP resulting from the project.

The aim of this paper is to analyze the evolution of Industrial source of funding and discuss the variables affecting the distribution of industrial funding with other University indicators, included quality indicators. We have found that only complex indexes that enclose several aspects of the research organization and performance could positively drive attractiveness of industrial funds. We also find that for scientific sector ranking scores are strictly related with industry attractiveness, while we exclude that single variables (as for example Number of staff or Government income) may generate a particular or positive influence. Our results show that a good University performance may facilitate an external collaborations, but definitively it can foster mutual benefit in University-Industry frame of relations.

Although the set of available data and the several Universities examined, this research presents some caveats. It tries to design a general situation, but at University level, marginally considering the department level, that generate a great variability across results. Further researches should be dedicated to the examination at a department level of different economic and organization attitudes. More attention should be devoted also to quality perception of scientific outputs by industry actors, by using not only economic variables but also multidimensional qualitative measures of Research activities, to identify the decisional process supported by industries in the choice of their academic partner.

References

1. Arundel, A., Geuna, A.: Proximity and the use of public science by innovative European firms. Economics of Innovation and New Technology, Taylor and Francis Journals 13(6), 559–580 (2004)
2. Arvanitis, S., et al.: University-industry knowledge and technology transfer in Switzerland: What university scientists think about co-operation with private enterprises (2008)
3. Baldini, N., Grimaldi, R., Sobrero, M.: Institutional changes and the commercialization of academic knowledge: A study of Italian universities' patenting activities between 1965 and 2002. Research Policy 35, 518–532 (2006)
4. Bercovitz, J., Feldman, M.: Fishing upstream: Firm innovation strategy and university research alliances. Research Policy 36, 930–948 (2007)
5. Bleiklie, I.: From Individual Pursuit to Organised Enterprise: Norwegian Higher Education Policy and the Postgraduate Curriculum. European Journal of Education 29(3) (1994)

6. Bonaccorsi, A.: Universities and strategic knowledge management. Elgar Publishing, UK (2007)
7. Bruneel, J., D'Este, P., Salter, A.: Investigating the factors that diminish the barriers to university-industry collaboration. Research Policy 39, 858–868 (2010)
8. Capano, G.: L'Università in Italia, il Mulino, Bologna (2000)
9. Capano, G., Regini, M.: Tra didattica e ricerca: quali assetti organizzativi per le università italiane? Le lezioni dell'analisi comparata, Roma, Fondazione CRUI (2011)
10. Caputo, A., Palumbo, M.: Manufacturing re-insourcing in the textile industry: A case study. Industrial Management & Data Systems 105(2), 193–207 (2005)
11. Cineca Website, http://www.cineca.it, http://www.vtr2006.cineca.it (accessed March 15, 2012)
12. Clark, B.R.: Diversification of Higher Education: Viability and Change. In: Meek, V.L. (1996)
13. Cohen, Levinthal: The absorptive Capacity: A new Perspective on Learning and Innovation. Administrative Science Quarterly 35, 128–152 (1990)
14. D'Este, P., Patel, P.: University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry? Research Policy 36, 1295–1313 (2007)
15. de Boer, H.F., Enders, J., Leisyte, L.: Public sector reform in Dutch higher education: the organizational transformation of the University. Public Administration 85, 27–46 (2007)
16. Di Gregorio, D., Shane, S.: Why do some universities generate more start-ups than others? Research Policy 32(2), 209–227 (2003)
17. Etzkowitz, H.: An Entrepreneurial Science. Routledge (2003)
18. Etzkowitz, H., Leydesdorff, L.: Research Policy 29(2) (2000)
19. Feller, I.: New organizations, old cultures: Strategy and implementation of interdisciplinary programs. Research Evaluation 11, 109–116 (2002)
20. Fini, R., et al.: Complements or substitutes? The role of universities and local context in supporting the creation of academic spin-offs. Research Policy 40, 1113–1127 (2011)
21. Geuna, A.: The Economics of Knowledge Production: Funding and the Structure of University Research. Edward Elgar, Cheltenham (1999)
22. Geuna, A.: The Changing Rationale for European University Research Funding: Are there Negative Unintended Consequences. Journal of Economic Issues 35, 607–632 (2001)
23. Giuliani, E., Arza, V.: What drives the formation of 'valuable' university–industry linkages?: Insights from the wine industry. Research Policy 38(6), 906–921 (2009)
24. Grossman, Helpman: Income distribution, product quality, and international trade (1991)
25. Gulbrandsen, M., Slipersaeter, S.: The Third Mission and the Entrepreneurial University Model. In: Bonaccorsi, A., Daraio, C. (eds.) Universities and Strategic Knowledge Creation: Specialization and Performance in Europe. Edward Elgar Publishing, Cheltenham (2007)
26. Hauptman, A.M.: Higher Education Finance:Trends and Issues. In: James, J.F., Forest, J.J., Altbach, P.G. (eds.) International Handbook of Higher Education (2006)
27. Herbst, M.: Financing Public Universities: the case of performance funding. Springer (2007)

28. Lundvall, B.A.: National System of innovation-toward a theory of innovation and interactive learning. Pinter Publishers, London (1992)
29. Mansfield, E.: Academic research and industrial innovation: an update of empirical findings. Research Policy 26, 773–776 (1998)
30. MIUR. Italian Ministry of Instruction, University and Research, http://www.miur.it (accessed March 15, 2012)
31. Moscati, R., Regini, M., Rostan, M.: Torri d'avorio in frantumi? Dove vanno le università europee, Bologna (2010)
32. Mowery, D., Nelson, R., Sampat, B., Ziedonis, A.: Ivory Tower and Industrial Innovation: University-Industry Technology Transfer Before and After the Bayh-Dole Act in the United States. Stanford University Press, Stanford (2004)
33. OECD, Frascati Manual. Proposed Standard Practice for Surveys on Research and Experimental Development. OECD, Paris (2002)
34. Olsen, J.: European Debates on the Knowledge Institution: The Modernization of the University at the European Level. Higher Education Dynamics 19(Pt. 1), 3–22 (2007)
35. Palumbo, R.: L'Università nella sua dimensione economico aziendale. Evoluzione sistemica e modelle razionalizzanti, Giappichelli (1999)
36. Salmi, Hautman: Innovations in Tertiary Education Financing: A Comparative Evaluation of Allocation Mechanisms. Working paper series world Banck (2006)
37. Slaughter, S., Leslie, L.: Academic Capitalism. Johns Hopkins University Press, Baltimore (1997)
38. Turri, M.: L'università in transizione. Guerini Studio (2011)
39. Zucker, L.G., Darby, M.R., Armstrong, J.S.: Commercializing knowledge: University science, knowledge capture, and firm performance in biotechnology. Management Science 48(1), 138–153 (2002)