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HOW DO UNIVERSITY RULES AND LOCAL GOVERNMENT  
INSTITUTIONAL QUALITY AFFECT THE PROBABILITY OF  
ACADEMIC SPINOFF CREATION?

Received: 30 January 2021 / Accepted: 3 October 2021

**Abstract**

By using a rich, partly proprietary database containing granular data on Italian universities’ characteristics and knowledge transfer strategies, we investigate the effect of university rules and local institutional quality dimensions on the probability of academic spinoff creation. We also suggest that local institutional quality dimensions sometimes compensate for, and sometimes complement, internal university rules on knowledge transfer activities.

**JEL CLASSIFICATION:** D02; L26; O33.

**KEYWORDS:** ENTREPRENEURSHIP; ACADEMIC SPINOFF;  
INSTITUTIONAL DIMENSIONS; KNOWLEDGE TRANSFER  
STRATEGIES.

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## **1. Introduction**

One widely shared view in the recent scientific debate is that academic research can be of considerable importance in building the foundations for technological change and economic competitiveness (Laredo, 2007). Universities can play a significant role in the fertilization of the economic context, producing new knowledge and adopting strategies that trigger knowledge transfer (KT) to industry. In a policy context that views entrepreneurship as an ingredient for economic development (Hartog et al., 2010), academic spinoffs have thus received increasing attention, with the scientific literature mainly focusing on the identification of the determinants, at various levels, of academic spinoff creation performance.

Initially, analyses expressed the individual characteristics of researchers and selected structural characteristics of universities (e.g., size, funding sources, presence of technology transfer or industry liaison offices). More recent approaches have emphasized the relevance of universities' strategic and institutional features (Caldera and Debande, 2010; Fischer et al., 2019; Lach and Schankerman, 2008; Muscio et al., 2016, 2015; Olaya-Escobar et al., 2020; Soares et al., 2020; Van Looy et al., 2011); the support mechanisms developed for both academic entrepreneurship and KT, in particular the quality and scope of academic rules and institutional policies related to the third mission of universities; monetary and nonmonetary incentivization schema established for researchers; and well-defined and clear KT strategies.

Concurrently, a broad range of regional and innovation literature has underlined the decisive impact that local institutions may have on the economic growth and development of a territory (Clò et al., 2020; Helpman, 2004; Rodriguez-Pose and di Cataldo, 2015). Building on the works of North (1990) and Baumol (1990), it has been maintained that institutions contribute to shape the incentives scheme underlying individual choices, and that there is a multifaceted link between the quality of institutions and economic results (Nifo and Vecchione, 2014). Systematic theoretical and empirical insights about entrepreneurship across different institutional environments have been provided quite recently (Agostino et al., 2020; Lv et al., 2020). The availability of such data has been encouraged by efforts such as the World Bank's Worldwide Governance Indicators (WGI) research program, which identifies reference indicators for institutional quality (Kaufmann et

al., 2009) and similar country-specific initiatives (as for Italy, see Nifo and Vecchione, 2014).

Despite the number of studies focusing on academic spinoff creation, and although some attention has been given to the role played by certain elements of the institutional environment, both within (for instance the presence of technology transfer offices - TTOs, see Baldini et al., 2014; Fini et al., 2017; Hayter et al., 2018; Skute, 2019) and outside of universities (i.e., local, social, regulatory and organizational characteristics, see Fini et al., 2011), there has been no systematic analysis of the effect of both university rules and local, institutional quality on academic spinoff creation.

Two relatively recent studies have taken steps to address this gap, by focusing on the effects on academic spinoff creation due to the wide range of internal rules adopted by Italian universities for KT activities (Muscio et al., 2016, 2015). We believe that such a research framework can be complemented by one concerning local institutional quality. Some dimensions of quality have proven to be relevant for nonacademic entrepreneurship (Agostino et al., 2020; Chipalkatti et al., 2011; Goel and Göktepe-Hultén, 2013; Lv et al., 2020). As noted by Agostino et al. (2020, p. 815), “institutional differences may matter even at a subnational level provided that heterogeneity in local institutions is large enough. Italy is a case in point.”

Such an attempt is interesting from both theoretical and empirical points of view. On the one hand, some scholars have highlighted that the process of establishing academic spinoffs is different from that of other start-ups or corporate spinoffs (Conceição et al., 2017). Therefore, the evidence that has emerged about the role of institutional quality in entrepreneurship cannot be fully confirmed for academic spinoffs. On the other hand, it has been maintained that universities are often crucial in supplementing certain services in underdeveloped local context conditions (Fini et al., 2011) and that universities located in weak entrepreneurial contexts tend to adopt proactive and supportive models for spinoff development (Muscio et al., 2016). Thus, according to these findings, university rules and local institutional quality might be, to some extent, substitutes.

The aim of this research note is to drop a seed into the field. We show that noteworthy evidence emerges when the effect on the probability of academic spinoff creation is empirically investigated, by assessing dimensions of both local and university institutional quality as measured by the adoption of

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specific rules regulating spinoff creation and other possibly related KT activities.

## **2. Data and econometric strategy**

Our econometric exercise is aimed at assessing the relevance of both academic rules and provincial institutional quality on the probability that universities engage in academic spinoff creation over the 2006-2011 period. The analysis relies on four main data sources: 1) the Netval database<sup>1</sup>, which includes information on Italian academic spinoffs that are annually generated by Italian universities; 2) an original database of detailed information on the past and current rules and regulations set forth by Italian universities on KT initiatives, including spinoffs, patents, and contract research); 3) a database made available by the Italian Ministry of University and Research (MIUR), covering the 2005–2012 period, which provides detailed, annual data on the amounts and sources of academic funding, departments, research staff and infrastructures supporting KT (such as TTOs and ILOs); and 4) information on elementary indices (corruption, government effectiveness, regulatory quality and rule of law) of provincial institutional quality between 2004 and 2012 collected from a database made available by Nifo and Vecchione (2014). See Table 1 for a brief description of the variables and the related summary statistics.

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<sup>1</sup> Available at: <http://www.netval.it>

**Table 1. Descriptive and summary statistics.**

Variable Name	Description	Mean	SD	Min	Max
<b><i>Dependent variable</i></b>					
spinoff_y	At least one spinoff during the year (y/n)	0.63	0.48	0	1
<b><i>General characteristics of the University</i></b>					
reg_spinoff	Internal specific Regulation on spinoff (y/n)	0.71	0.45	0	1
reg_contract_research	Internal specific Regulation on contract research (y/n)	0.90	0.29	0	1
tto	Technology Transfer Office (y/n)	0.87	0.34	0	1
dimension	Dimension >15,000 students (y/n)	0.67	0.47	0	1
polytechnic	Polytechnic (y/n)	0.06	0.24	0	1
ln_sc-based_firms	Number of scientific-based firm in the province (log)	5.98	1.08	3.66	8.37
ln_cumul_spinoffs_1	Cumulated number of academic spinoffs (log, t-1)	1.96	1.00	0	4.14
ln_res_contract_1	Value of research contracts (log, t-1)	7.52	1.87	0	10.57
ln_pub_funding_1	Value of public funding (log, t-1)	8.23	1.47	0	10.59
ln_number_patents_1	Number of patents (log, t-1)	1.50	2.51	-2.30	5.89

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***Specific University Rules on knowledge transfer activities***

business_plan_format	Predefined format for business plans made available by the university (y/n)	0.11	0.31	0	1
incompatibility	Explicitly identified incompatibility situations (y/n)	0.09	0.28	0	1
evaluation_committee	Evaluation Committee for KT initiatives (y/n)	0.65	0.48	0	1
limit_contracts_parent_univ	Maximum limit on research contracts from parent university (y/n)	0.09	0.28	0	1
contres_withholding	Share of revenues from contract research withheld by the university	0.18	0.17	0	0.86
patent_withholding	Withholding on patent sales (y/n)	0.55	0.50	0	1
<b><i>Institutional Quality Dimensions*</i></b>					
corruption	Corruption	0.83	0.16	0	1
government	Government Effectiveness	0.42	0.19	0	1
regulatory	Regulatory Quality	0.51	0.19	0	1
rule_of_law	Rule of Law	0.55	0.18	0.12	1

Notes: \* for details on the composition of the indexes, see Nifo and Vecchione (2014).

We estimate a pooled probit in which the dependent variable takes a value of 1 if the university created at least one spinoff in the year and 0 otherwise. For the independent variables, we include sets of the following covariates: general university characteristics (scale, past KT activity, internal regulations on spinoffs and contract research, presence of a TTO whether the university is a Polytechnic); the adoption of specific rules concerning spinoff creation, research contracting and patenting; four indices measuring provincial-level institutional quality dimensions (corruption, government effectiveness, regulatory quality and rule of law). We also include the (log of) the number of scientific-based firms in the province as a proxy for the local absorptive capacity and, simultaneously, serve as a control for possible

spillover effects, as well as year dummies and dummies related to the scientific areas supported by the university.

We opt for the pooled probit rather than for the panel data probit since the value of rho is nearly zero. Therefore, it can be assumed that the intrapanel correlation is small enough to ignore; the results are almost identical.

To address potential endogeneity issues between the dependent variable and the regressors concerning funding from other KT-related activities (patenting, contract research, access to public funding), we include these regressors lagged by one year. Additionally, we tend to exclude any possible endogeneity between the dependent variable and the independent variables related to provincial institutional quality. Since, in virtually every case, the location of the academic spinoff is at the parent university and not the outcome of a provincial-level localization choice based on their socioeconomic characteristics, we assume that the levels of provincial institutional quality can be considered exogenous (i.e., not correlated with the error). The variance inflation factor (VIF) analysis shows that the multicollinearity among the independent variables does not give rise to any concerns: the mean VIF is 2.05, while the highest value is 3.91, well below the suggested threshold of 10 (Hair et al., 2019).

### **3. Results**

Table 2 shows the results of the econometric estimates in terms of average marginal effects. Three different nested models are presented. In addition to both the year and scientific area dummies (common to all the specifications), the first model (Column 1) includes only regressors related to the general characteristics of the university. The second model adds covariates for the specific rules on KT activities adopted by each university (Column 2). In the third, full model, the institutional quality indices covariates related to corruption, government effectiveness, regulatory quality and rule of law are also considered (Column 3). Table 2 also shows log-likelihood and Akaike Information Criteria (AIC) values for each estimated model.

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**Table 2. Pooled Probit regression results (Average Marginal Effects).**

	(1)	(2)	(3)
<b><i>General characteristics of the University</i></b>			
reg_spinoff	0.140** (0.0572)	0.237*** (0.0765)	0.307*** (0.0644)
reg_contract_research	0.216*** (0.0497)	0.406*** (0.0435)	0.472*** (0.0416)
tto	0.118 (0.0900)	0.0502 (0.0951)	0.0521 (0.0960)
dimension	-0.0281 (0.0784)	0.106 (0.0829)	0.218*** (0.0794)
polytechnic	0.198** (0.0990)	0.186** (0.0748)	0.252*** (0.0547)
ln_sc-based_firms	-0.00870 (0.0222)	-0.00709 (0.0200)	0.0188 (0.0234)
ln_cumul_spinoffs_1	0.177*** (0.0254)	0.196*** (0.0277)	0.239*** (0.0325)
ln_res_contract_1	0.0425** (0.0184)	0.0385** (0.0162)	0.0442*** (0.0168)
ln_pub_funding_1	-0.0320 (0.0252)	-0.0212 (0.0216)	-0.0284 (0.0228)
ln_number_patents_1	0.0174 (0.0116)	0.00558 (0.0109)	-0.000974 (0.0104)
<b><i>Specific University Rules on knowledge transfer activities</i></b>			
business_plan_format		0.129*** (0.0454)	0.164*** (0.0403)
incompatibility		0.142*** (0.0539)	0.129** (0.0500)
evaluation_committee		-0.121** (0.0490)	-0.160*** (0.0387)
limit_contracts_parent_univ		-0.201* (0.106)	-0.254*** (0.0755)
contres_withholding		-0.620*** (0.165)	-0.899*** (0.195)
patent_withholding		-0.127*** (0.0393)	-0.125*** (0.0350)



***Institutional Quality Dimensions***

corruption			-0.144 (0.197)
government			0.355** (0.163)
regulatory			-0.535*** (0.155)
rule_of_law			0.475*** (0.115)
log-likelihood	-152.01	-138.42	-131.40
Akaike Information Criteria (AIC)	364.03	348.83	342.80
<i>Observations</i>	<i>344</i>	<i>344</i>	<i>344</i>
<i>N. of idu</i>	<i>54</i>	<i>54</i>	<i>54</i>
<i>Area dummies</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>
<i>Year dummies</i>	<i>YES</i>	<i>YES</i>	<i>YES</i>

In parentheses: standard errors clustered at the University level. Statistical significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The full Model 3 results for the control variables are aligned with the findings of previous literature: a positive effect on the probability of academic spinoff creation is associated with a larger scale of the university (+21.8%), being a Polytechnic (+25.2%), and past experience of spinoff creation and engagement in contract research (+23.9% and +4.4%, respectively). Neither the presence of a TTO, the amount of government research funding received, nor the number of patents appears to play any role. For the variables related to internal KT-specific rules, their roles and signs are as follows (and consistent with previous findings in the literature): among the general rules and procedures, positive determinants include the existence of specific regulations for spinoffs (+30.7%) and research contracts (+47.2%), as well as rules that reduce researchers' uncertainty (incompatibility: +12.9%); in contrast, the existence of an evaluation committee has a filtering effect (-16%). The importance of monetary incentives is confirmed, as well. A negative effect on the probability of spinoff creation is associated with both the share of revenues withheld by the university for contract research (a 10% increase in the share of revenues

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withheld by the university is associated with a 9% decrease in spinoff creation likelihood) and the existence of withholdings on patent commercialization (-12.5%). Last, except for corruption<sup>2</sup>, the elementary indices of institutional quality show statistically significant average marginal effects: positive for government effectiveness and rule of law (an increase of 0.1 in the value of these indices implies an increase in the probability of 3.6% and 4.6%, respectively); negative for regulatory quality (-5.3%).

Additional cues come from Table 3, which shows the average marginal effects of the institutional quality variables, calculated as representative values (0 and 1) for selected university rules on KT activities. This preliminary econometric exercise is aimed at providing an initial idea of how university rules and local institutional frameworks may interact. For example, the marginal effect of *government effectiveness* is positive, regardless of the adoption of a specific spinoff regulation by the university. However, the value of the marginal effect decreases when the university adopts such a regulation (diff: -6.8%).

**Table 3. Caption of the table.**

	Spinoff Regulation			Rule on Incompatibility		
	No	Yes	diff: Yes-No	No	Yes	diff: Yes-No
Government Effectiveness	0.40**	0.34**	-6.8%	0.36**	0.29*	-7.0%
Rule of Law	0.54***	0.45***	-9.0%	0.48***	0.38***	-9.3%

  

	Evaluation Committee			Limit on Revenues from Parent University		
	No	Yes	diff: Yes-No	No	Yes	diff: Yes-No
Government Effectiveness	0.27**	0.34**	7.1%	0.35**	0.37**	2.1%
Rule of Law	0.36***	0.46***	9.6%	0.47***	0.49***	2.8%

Notes: since the variables of interest are dichotomic, the selected values are 0 and 1.

<sup>2</sup> This result is not necessarily in contrast with the previous literature on institutional quality and entrepreneurship. The papers according to which *corruption* is relevant focus on the *control* of corruption (Lv et al., 2020), which can actually be associated with *rule of law* in our paper, or to *perceived* corruption (Aparicio et al., 2016), which is not mapped in the database by Nifo and Vecchione.

#### **4. Discussion and conclusions**

Our note describes some intriguing and original results. Higher provincial government effectiveness (i.e., efficient local government in the provision of public services, a rich endowment of economic and social infrastructures) reduces transaction costs and the burden of bureaucracy, thus stimulating (academic) entrepreneurship. A higher value of the rule of law index implies a more intense accumulation of physical, social and human capital that reduces uncertainty, thus positively contributing to the probability of academic spinoff creation. Interestingly – and this is a notable finding, different from the evidence provided in the nonacademic entrepreneurship literature – the regulatory quality index shows a negative relationship with academic spinoff creation. This index measures the capability at the local level to favour a higher degree of openness of the economy, a “healthier” business environment. In provinces with a stronger and livelier private sector and with a more competitive environment, there is a lower probability of universities creating spinoffs. Pending further research on this point, we can envision at least two possible explanations for such an outcome. First, as previously described, universities located in weak entrepreneurial contexts tend to adopt proactive and supportive models for spinoff development and play a supplementary function. Second, more dynamic economic environments might have better opportunities for researchers to commercially exploit a piece of new knowledge, because of a higher chance of contact with private firms interested in patent acquisition/licensing. In such a context, it might be more convenient for the researcher to monetize her intellectual property through KT channels instead of the more complex and more long-term creation of an academic spinoff.

Another insight is that government effectiveness and rule of law are less relevant for academic spinoff creation if the university adopts rules and procedures that clarify its KT strategy (Note: the marginal effects are positive but the difference is negative when comparing the absence and the presence of both specific spinoff regulations and incompatibility rules, see Table 3). In these cases, it seems that university and local institutional quality are somehow fungible. However, the positive effects of both an efficient local government and a well-designed legal framework are even stronger when universities adopt more invasive spinoff strategies that impact the incentives scheme for researchers (such as the presence of an evaluation committee or the limitation on spinoff revenues from the parent university).

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In such situations, we may suppose that higher institutional quality serves as an “external” guarantee for researchers.

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