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DOES THE INNOVATIVE BEHAVIOR MATTER FOR HOTELS' PERFORMANCE? EVIDENCE FROM ITALIAN ACCOMMODATION SECTOR

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SOMMARIO

The literature on innovation in the tourist sector is scanty. Moreover, while previous studies do not consider an explicit measure of innovative performance, our analysis is based on micro-data on successful patents application in the Italian hospitality sector. Even if there are reasons to consider that not all the innovations in the tourist sector can be covered by patents, there is a lot to learn from an analysis of the patenting behavior and of its effects on performance. This study aims at analyzing: a) the determinants of patenting behavior in the Italian hospitality sector; b) the impact of innovation – measured through firms' patenting activity - on firms' performance. We document the determinants of the innovative activity and its impact on firms' performance using micro-data from Aida and Orbis databases (Bureau van Dijk). We find that the firms' innovative performance in the Italian hospitality sector – measured through the number of successful patents applications – varies according to firms' size, age, financial structure, legal status and geographical location. Moreover, patenting activity has a positive and significant impact on hotels' turnover growth, profitability and productivity. This happens in spite of the fact that most of the patenting activity is typically concentrated in sectors that are outside the firms' core business. This is consistent with the notion (Atalay, Hortacsu, Syvertson, 2014) that more innovative firms are those with more managerial capital, and they also have a tendency to grow larger by expanding in neighboring sectors.

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1. Introduction

The literature on innovation in the tourist sector is scanty as it usually includes low-tech activities. However, throughout history, tourism has been a phenomenon characterized by immense innovativeness (Hialager, 2010). At the same time, patenting in the tourism sector has traditionally been quite limited. Innovation in the tourism sector exhibits some peculiar features that most traditional indicators would not capture, with the consequent risk of underestimating it. Innovation often occurs without the performance of formal R&D, and this is particularly true for firms operating in the tourist sector. This probably depends on the limited appropriability of innovations pertaining to the sector, as well as to the fact that patenting tends to be more prevalent with product innovations, whereas most of the innovation in tourism concerns managerial, management, institutional, product or services as well as process innovations. To overcome this problem, more recent studies have moved from an input definition of innovation activities to an output approach, by including in the analysis the outcome of the innovation process rather than its input.

The tourism sector has recently witnessed many radical changes, primarily driven by digitalization. Tourism has been one of the sectors mostly affected by digitalization (Aldebert, Dang and Longhi, 2011). Digitalization may have modified incentives to produce innovations, as well as incentives to patent them.

Within this framework, this study aims at analyzing: a) the determinants of patenting activity (output) in the Italian hospitality sector; b) the impact of innovation on firms' performance. This paper is not an attempt to describe all the innovative activities performed by hotels. Instead, having observed some patenting activity, this research investigates when it takes place and whether innovation outcomes impact hotels' economic performance.
To our knowledge, none of the empirical papers investigating the relationship between innovation and profitability/productivity has explicitly dealt with firms operating in the tourist sector. This is the first empirical investigation on the impact of hotels' patenting behavior on economic performance.

We first show the channels through which innovative firms expand into neighboring markets. Then, we document the determinants of the innovative activity and its impact on firms' performance using micro-data from Aida and Orbis databases (Bureau van Dijk).

While previous studies do not consider an explicit measure of innovative performance, our analysis is based on micro-data on successful patents application in the Italian hospitality sector. Even if there are reasons to consider that not all the innovations in the tourist sector can be covered by patents, there is a lot to learn from an analysis of the patenting behavior and of its effects on performance.

The reminder of the paper is organized as follows. Section 2 describes our theoretical model, Section 3 illustrates the empirical approach and the econometric results. Section 4 offers some preliminary conclusions and directions for further research.

2. A SKETCH OF A THEORETICAL MODEL

We show the channels through which innovative firms have an incentive to expand their production in neighboring sectors.

TO BE EXPANDED.

3. EMPIRICAL APPROACH

As mentioned above, the purpose of this research is to analyse the determinants of patenting activity in the Italian hospitality sector and its impact on firms' economic performance.

Our empirical approach is based on a two-step modeling. The first step corresponds to the firm decision whether to apply for a patent or not. From the first step we recover for each firm the predicted probability of successful patent applications. In the second step a performance function specifies the effect of innovative output on firms' turnover, profitability and productivity by including the predicted patent probabilities from the first step. Including the predicted value instead of the realized value in the second step accounts for the fact that all firms may have some kind of innovative effort, although only some of them apply for a patent.

I Step: the determinants of Patenting Behaviour

We first estimate a probit model in which the presence of patents is mainly regressed on a set of hotel-specific characteristics:

$$PAT_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 AGE_{it} + \beta_3 AGEsq_{it} + \beta_4 IATA_{it} + \beta_5 LF_{it} + \beta_6 MP_{it} + \gamma_t + u_i + \varepsilon_{it} \quad [1]$$

where *i* denotes hotels, observed over the 2003-2012 years.

γ_t denotes time effects, u_i firm effects and ε_{it} indicates the stochastic residuals.

PAT is a dummy variable equal to 1 for hotels with successful patents applications over the period 2003-2012; 0 otherwise.

SIZE of the firm is measured as the logarithm of firm's total assets. It can also be considered a proxy of organizational complexities and managerial differentiation (Orfila-Sintes et al. 2005).

AGE of the firm is measured as the difference between 2012 and its year of foundation. We also include its squared value in order to account for non-linear effects, like learning economies returns to scale.

IATA indicates intangibles over total assets. Intangible activity is particularly important for today's knowledge-based economy. Given the importance of knowledge-based capital, it would be desirable to take account of all intangible assets that firms can use to a different extent for their innovative activity. For this reason, differently from previous empirical analyses which focus on one or at most a few intangible at a time, we adopt a comprehensive account of intangibles.

LF indicates the legal form of the firms and equals 1 for limited companies, 0 otherwise.

Note that we also include 20 regional dummy variables in the regression.

II STEP: the Performance Function

In the second step, the objective is to evaluate the effect of hotels' innovative behavior on firms' performance by including the predicted patent probabilities PAT_{it} from the first step:

$$PERF_{it} = \alpha_0 + \alpha_1 PAT_{it} + \alpha_2 X_{it} + \gamma_t + u_i + \varepsilon_{it} \quad [2]$$

where *i* denotes hotels, observed over the 2003-2012 years.

γ_t denotes time effects, u_i firm effects and ε_{it} indicates the stochastic residuals.

Our dependent variable $PERF_{it}$, indicating firms' performance, will be in turn one of the following measures:

1) PROFITABILITY. We use EBITDA as measure of current operating profitability. It is an accounting measure calculated using a company's net earnings, before interest expenses, taxes, depreciation and amortization are subtracted. It indicates how much profit a company makes with its present assets and its operations on the products and services it sells. EBITDA is also a financial measurement of cash flow from operations. It is widely used in many areas of finance when assessing the

performance of a company and is intended to allow a comparison of profitability between different companies.

2) TURNOVER. A basic measure of firm performance is given by its annual turnover, measured as the log of total revenues (in real terms). In order to adopt a more meaningful measure of sales performance, we use firms' turnover growth rate, defined as percentage variation over previous year result:

$$Turnover\ growth\ rate = \frac{Turnover_t - Turnover_{t-1}}{Turnover_{t-1}}$$

3) PRODUCTIVITY. The productivity equation is specified as a simple Cobb-Douglas technology with constant returns to scale, and with labor, capital and knowledge inputs. In this case, our dependent variable is labor productivity, given by value added per employee, in logs (VA_EMP).

With reference to covariates, PAT_{it} indicates firms' patenting behaviour and is proxied by the predicted probability of successful patent applications, derived from the first step. This is also a proxy of knowledge inputs. Note that including the predicted patent probabilities in the regression accounts for the fact that all firms may have some kind of innovative effort although only some of them apply for a patent. Using the predicted value instead of the observed indicator is also a way to instrument the patenting behaviour in the performance function in order to deal with the potential endogeneity problem (because of simultaneity or measurement errors in variables) (Hall et al. 2009).

The X matrix includes additional explanatory variables.

As internal firm level control variables, we include:

- SIZE of the firm, measured as the logarithm of firm's total assets;
- AGE_{it} measured as the difference between 2012 and the year of foundation, and its square (in logs).
- INV, which indicates investment intensity as proxy for physical capital. It is given by investment in machinery per employee, in logs.
- Equity over total assets (EQTA), which is a measure of financial adequacy of firms with respect to their credit risk (in logs). The higher percentage of this ratio causes the lower risk and makes firm safer and profitable;
- Cost-Income Ratio (CIR), measured as Total expenses over Total Revenues (in logs). It shows the effect of operational efficiency on profitability.

As external factor we consider the Effective Tax Rate (ETR), as Total Taxes over Pretax Profit (in logs).

3.1 Source of Data and Descriptive Statistics

This study is mainly based on Italian firms' accounting data taken from the Aida database (Bureau van Dijk), while data on successful patents applications are taken from the Orbis database (Bureau van Dijk)[3]. Through the BvD ID number associated to each firm, we are able to perfectly match the data taken from these two different databases.

The advantage is that we have direct access to financial data on which the hotel managers are usually reluctant to provide detailed information. On the other hand, we cannot use additional qualitative information which, instead, could be collected through interviews or questionnaires.

With reference to patents, we mainly know their publication title, content and publication date. We consider as patenting companies all those firms with at least one successful patent application over the 2003-2012 years. Given this selection criterion, our dataset initially includes 202 patenting firms active the Italian

[3] The matching between the firms included in the Orbis database and the European Patent Register is carried out by Vadis [http://www.vadis.com], a company specialized in predictive modelling and data mining.

accommodation sector, 11% of which apply for a patent for the first time over the considered 10-year period. The majority of companies with successful patent applications over the observed period, already hold patents in previous years.
Note that all firms with successuful patent applications are included in the analysis, whereas non patenting firms are randomly selected from the population. The initial number of non patenting firms is 10490, while the final sample of non-patenting firms includes 386 hotels.

Table 1 shows some descriptive statistics. Patenting firms are, on average, larger and older than non-patenting hotels. They are also characterized by an higher percentage of intangibles over total assets, coherently with the expectations. Patenting firms register higher levels of turnover and profit than non-patenting firms which, on the other hand, often show negative current profits. Profitability measures are, on average, higher for patenting hotels than for non-patenting companies.

The labour productivity, instead, seems to be higher in non-patenting companies.

Table 1 – Summary Statistics

	Patenting Firms					*Non-Patenting Firms*				
	Obs.	*Mean*	*Std. Dev.*	*Min*	*Max*	*Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*
Size (Total Assets)	1340	15206.78	138247.4	0	2427216	2633	2265.8	4510.9	-155	52848
Age	1532	16.75	16.00	1	107	3045	15.97	13.53	1	79
Intangibles over TA	1324	0.228	0.288	-0.093	1	2611	0.200	0.296	-0.333	3.713
Legal Form	1532	0.071	0.258	0	1	3045	0.034	0.183	0	1
Turnover (in ths euros)	1339	12751.7	106007.1	0	1352687	2633	966.01	1487.48	0	31006
Profit	1326	119.76	3672.97	-84778	48109	2615	-12.88	378.66	-6959	5253
Ebitda	1340	1339.56	11670.86	-5641	164198	2633	135.69	418.51	-4390	7249
VA_EMP	773	34.27	28.36	-39.2	447	1557	39.48	54.92	-272	730
Investment Intensity	1178	14.07	37.38	0	493	726	12.08	26.67	0	234
EQTA	1320	0.968	14.03	-81	477.66	2596	0.418	5.127	-94	42
CIR	1250	1.457	8.552	0	259.41	2528	1.242	5.664	-1.79	214.33
ETR	1313	0.317	1.414	-17.5	14	2609	0.338	2.14	-40	47

Fonte: own elaborations on Aida database

3.2 Empirical Results

Table 2 reports probit estimates on the determinants of patent probability and their marginal effects. As the first-order conditions are non-linear with respect to parameters, a numerical approximation is used, producing convergence after 19 reiterations. The maximized value of the log-likelihood function is -376.169. LR chi-square (21) is the asymptotic version of the *F*-test for zero slopes. The *p*-value rejects the null hypothesis that all the coefficients are simultaneously equal to zero, so the model as a whole is statistically significant. In total, around 68.9% of predicted probabilities are correctly classified.
As we expect, firm size, which can be considered a proxy of managerial differentiation, is significant with a positive marginal effect, showing the importance of economies of scale. Larger accommodation structures – like international hotel chains - are expected to invest an higher amount of resources in innovative activities and to patent more often simply because they are bigger and employ patent lawyers and other personnel also for this purpose.

Age is significant at the 1% level with a positive sign, presumably indicating the importance of experience for innovation and, to some extent, the presence of learning economies also attributable to persistence in

innovative activity. Coherently with this result, the majority of hotels with successful patent applications over the observed 2003-2012 period, already hold patents in previous years. Age-squared has been included in the probit model to capture non-linear effects. Empirical findings show that it is significant with a negative sign, indicating decreasing returns to scale.

As to the other explanatory variables, intangible activity is strongly significant with a positive marginal effect. The great relevance of intangible activity on firms' innovation output has been widely claimed in academic research. The "system approach" to innovation (Carlsson et al., 2002) and the "open-innovation mode" (Chesbrough, 2003) highlight the importance of all intangible assets as crucial innovation inputs through which firms can introduce both technological and non-technological innovations: training, software development, company reputation and branding, design of products and services, organization or business process improvements. Tourist sector, in particular, is much less physical assets-centric than the other sectors; thus, as expected, we find a strong significant impact of intangibles as a whole on innovation output.
Empirical evidence shows that patent probability is also strongly affected by hotels' legal form. The results, in accordance with the findings on the other covariates, indicate that being a limited company would increase the probability of successful patent applications.
Regional dummies, unreported but available on request, are almost significant at 1% or 5% level.

Table 2 – Determinants of Patenting activity (STEP 1), Probit estimates

Dependent variable: Probability (PAT>0)	*Coeff.*	*Marginal Effects*
SIZE (in logs)	0.056***	0.021***
	(0.015)	
AGE	0.014***	0.005***
	(0.003)	
AGEsq	-0.073***	-0.027***
	(0.022)	
IATA	0.080***	0.029***
	(0.012)	
LF (*)	0.583***	0.227***
	(0.116)	
Constant	-0.315	
	(0.260)	
Regional Dummies	included	
Pseudo *R*-squared	0.12	
Number of observations	3289	

Note: Standard errors in parentheses. * Significant at 10%, ** significant at 5%, *** significant at 1%.

(*) Marginal effect of LF, dy/dx, is for discrete change of dummy variable from 0 to 1.

Table 3 presents the empirical findings on the impact of hotels' patenting activity on their economic performance, expressed through different measures.

The results of Eq. [2] estimation over the 2003-2012 period are reported on Table 3. As it is shown, the *F* test null hypothesis that all the coefficients are jointly equal to zero is always rejected at 1% level. The Hausman specification test is performed to investigate the correlation between the unobserved individual effect and the observed explanatory variables. In all the regressions we reject the null hypothesis that the difference in coefficients is not systematic, thus we use a fixed effect model.

The empirical evidence shows interesting results. Indeed, despite the low technological content of the tourist sector, patenting activity has a positive impact on hotels' performance. Patent probability enters significantly in all the regressions suggesting a relevant effect on firms' turnover growth, profitability and productivity. Note, however, that the coefficient associated to patent probability is relatively higher in the regressions

explaining the determinants of turnover percentage variation and profitability, thus the impact of innovative behavior on performance would be mainly exterted throght commercial channels. Innovative accomodation structures are expected to increase their total revenues by selling patented products in the tourism market and/or in parallel markets. The lowest impact of patenting activity - though positive and significant - is generated on labor productivity.

Size enters with positive sign, but while it is significant in explaining establishments' profitability, it is not significant in explaining turnover growth rate and labour productivity across Italian accommodation structures. The impact of size on profitability is complex and may be both positive and negative. On one hand, larger hotels are expected to adopt more sophisticated commercial and managerial strategies in order to improve their products and services and increase their earnings. On the other hand, large firms face more expenses, such as the higher agency and organizational costs which can reduce the profitability. Our findings suggest that hotels can gain from economies of scale since, as companies grow, they will be able to comparatively reduce the costs and achieve better financial results.

Age enters with negative sign suggesting that, *ceteris paribus*, younger companies are more dynamic than the older ones and show a greater potential for economic growth. Non-linear effects are found – with opposite sign - for turnover growth and profitability, but not for productivity.

Investment intensity, measured as investment in machinery per employee, has a positive and significant impact on all the considered performance measures, but the highest effect is generated on labour productivity.

The impact of EQTA is positive, but while it strongly affects the profitability of Italian accommodation structures, it enters at 10% level of significance in explaining hotels' productivity and their turnover growth rate. With respect to profitability, and coherently with the expectations, hotels with higher level of equity ratios would face lower funding costs and would need less debt to finance their operations, so leading to a better economic performance.

The Cost-Income Ratio (CIR), which captures the effect of operational (in)efficiency on our dependent variables, enters at 1% level of significance with negative sign in all the three regressions, but the impact is relatively higher on turnover growth rate.

ETR enters with negative sign, but it significantly affects only the profitability of accommodation structures. We find no effect of taxes on turnover growth and productivity.

Time fixed effects are included in all the regressions as we reject the null hypothesis that all years coefficients are jointly equal to zero. Year dummies are almost significant at 1% or 5% level and they enter with negative sign since 2007, indicating a negative impact of the international financial crisis on firms' performance.

Table 3 – Performance Function (STEP 2), Turnover and Profit – Fixed Effects Model

Dependent variable:	*TURNOVER GROWTH* (1)	*PROFITABILITY* (2)	*PRODUCTIVITY* (3)
PAT	2.355**	2.633***	1.245**
	(1.070)	(0.560)	(0.529)
SIZE	0.129	0.226***	0.022
	(0.019)	(0.029)	(0.029)
AGE	-0.196***	-0.055***	-0.047***
	(0.036)	(0.009)	(0.008)
AGEsq	-0.258*	0.204***	0.031
	(0.139)	(0.033)	(0.035)
INV	0.261***	0.088**	0.670***
	(0.226)	(0.040)	(0.024)

EQTA	0.002*	0.073***	0.033*
	(0.013)	(0.020)	(0.020)
CIR	-1.324***	-0.255***	-0.198***
	(0.224)	(0.036)	(0.053)
ETR	-0.030	-0.050***	-0.015
	(0.069)	(0.019)	(0.018)
Time fixed effects	included	included	included
Constant	0.641	1.964**	2.172***
	(1.086)	(0.280)	(0.287)
R-squared	0.13	0.25	0.12
F test	8.94***	12.46***	4.96***
Firm effects (*F* test)	1.68***	9.52***	5.85***
Time effects (*F* test)	5.20***	1.76*	4.31***
Number of observations	1059	1789	1162

Note: Standard errors in parentheses. * Significant at 10%, ** significant at 5%, *** significant at 1%.

4. CONCLUSIONS

This study aims at analyzing the determinants of the innovative activity in the Italian hospitality sector and the impact of innovation – measured through firms' patenting activity - on firms' performance.

We first show the channels through which innovative firms expand into neighboring industries. We then document the determinants of patenting behaviour and its impact on firms' performance using micro-data from Aida and Orbis databases (Bureau van Dijk).

Results show that the firms' innovative performance in the Italian hospitality sector – measured through the number of successful patents applications – varies according to firms' size, age, financial structure, geographical location and legal status. All the explanatory variables are significant in explaining firms' patenting probability with the expected sign.

We then find that, despite the low technological content of the tourist sector, patenting activity has a positive impact on hotels' performance. Patent probability enters significantly in all the regressions suggesting a relevant effect on firms' turnover growth, profitability and productivity. However, that the coefficient associated to patent probability is relatively higher in the regressions explaining the determinants of turnover percentage variation and profitability, thus the impact of innovative behavior on performance would be mainly exterted throght commercial channels. Innovative accomodation structures are expected to increase their total revenues by selling patented products in the tourism market and/or in parallel markets. The lowest impact of patenting activity - though positive and significant - is generated on labor productivity.

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