A panel data analysis of Italian hotels

Un'analisi di dati panel di hotel italiani

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Abstract The present paper aims at presenting a study on the performance of the hotel industry in Italy, by analysing a panel of firms (ATECO 55.1) in the years 2008-2015. After an analysis of price and operating cost changes at the aggregate level (paragraph 2), a quantile regression is applied on microdata for modelling total production (sales). The model tries to distinguish the contribution of the quantity and quality of labor.

Abstract *Il lavoro propone un'analisi della performance dell'industria alberghiera in Italia, analizzando un panel di hotel (ATECO 55.1) negli anni 2008-2015. Dopo un confronto fra costi e prezzi a livello aggregato (paragrafo 2), il lavoro procede con l'applicazione della regressione quantile sui microdati, per modellare l'andamento della produzione in funzione dei fattori produttivi. Particolare attenzione è rivolta al fattore lavoro*.

Key words: hotel industry, operating costs, production, panel data.

1. Introduction

Hotels have a variety of internet distribution channels in selling rooms but the cost of using those intermediaries is considerable. Online Travel Agencies (OTA) and opinion aggregator websites have deeply changed the structure of the hospitality industry with consequences in the mechanisms of economic value creation (Toh, Raven, DeKay, (2011); Santoro, (2015)). It follows that an interesting issue can be the analysis of hotel operating costs and productivity. In this respect, even though the most used metrics in hotel industry refer to the number of rooms (room occupancy

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rate, revenue per available room, etc.), the presence of an intensive rivalry among firms generates high pressure to increase efficiency and productivity, so that traditional accounting measures are used, as well (Sainaghi, (2011); Sainaghi, Phillips, Zavarrone, (2017)).

As far as productivity and efficiency are concerned, current research at micro level encounters difficulties in selecting input and output, in their measurement and modelling and, namely, many empirical analyses are carried out on primary survey data of limited size (Sainaghi, Phillips, Zavarrone, (2017)). However, there are also applications of traditional growth accounting for hotel and restaurant industries (Smeral, (2009)).

The present work develops an analysis of accounting data of a panel of Italian hotels in the years 2008-2015. Two main issues are addressed: 1) whether the cost changes of inputs are recovered by output price changes; 2) an evaluation of the contribution of production factors, by the estimation of a function explaining total production (sales) through the regression quantile approach. A special attention is given to labor, as we have tried to distinguish between labor quantity and quality. In fact, human resources are a key factor in the service sector and in the accommodation industry in particular. Moreover, the increasing number of services offered by hotels (suites, dining and banquet facilities, etc.) often requires skills that are far away from the hotel core competencies (Hemmington, and King, 2000; Gonzalez-Rivera, 2005). In many cases, outsourcing is an effective way to overcome those problems.

Data are derived from Aida database, and refer to more than 3000 Italian hotels. Unfortunately, Aida database does not provide information about hotel category (number of stars) or number of rooms.

The paper is structured as follows. Section 2 presents the analysis of process and costs at the aggregate level. Section 3 describes the results of the model estimation.

2. Operating costs, operating margin and productivity

The operating-revenue to operating-cost ratio (*RVC*) and global productivity (*GP*) at time *t* are defined respectively as (Bosch-Badia, (2010)):

$$RVC_t = \frac{RV_t}{OC_t} = \frac{Operating\ revenue\ at\ current\ prices}{Operating\ costs\ at\ current\ prices}$$

$$GP_{t,0} = \frac{Operating\ revenue\ at\ constant\ prices}{Operating\ costs\ at\ constant\ prices}$$

Let be $opc_{t,0}$ the synthetic price index of outputs and $ipc_{t,0}$ as the synthetic price index of inputs, at base 0. The ratio between these two price indexes is:

$$pch_{t,0} = \frac{opc_{t,0}}{ipc_{t,0}} \quad \text{so that} \quad RV_t = GP_t\ pch_{t,0}$$

Finally, considering m_t as the operating margin:

$$m_t = \frac{RV_t - OC_t}{RV_t} = 1 - \frac{1}{GP_{t,0}\ pch_{t,0}}$$

and $T_t = RV_t/A_t$ as the asset turnover (A_t is total assets), we derive ROA (Return

On Assets) as:

$$ROA_t = T_t\left(1 - \frac{1}{GP_{t,0}\ pch_{t,0}}\right) = T_t\ k_t$$

where k_t represents the conversion coefficient of turnover into ROA.

Operating revenue is total sales; operating costs are: intermediate costs (materials, services etc.), labour costs and other costs (including capital depreciation). All current figures are also expressed at 2008 constant prices. Details of the deflation operations are given. The price index of output (*opc*) is computed by the ratio between current and constant price values of total production for the sector 55 (ATECO 2007). The labour cost index is provided by National Statistical Institute (ISTAT) that also releases price indices for capital depreciation. The implicit price index of intermediate costs is derived from column totals of the use-matrix (ATECO 55), by comparing values at constant and current purchase prices (*use table method*). However, as use-supply tables are available until 2013, we have provided an alternative price index (*method 2*), by applying the weights from the use-table (column values at current prices) to the price indexes of sectorial total (instead of intermediate) production (for 2014 and 2015, weights from the 2013 use-table are employed). As can be argued from Table 1 and Figure 1, the time pattern 2008-2013 of the two alternative index numbers is nearly similar but not their level. As the price index derived from the use-table is more consistent with our analysis, we have estimated 2014 and 2015 values assuming the same growth rate of the price indexes from *method 2* (Figure 1).

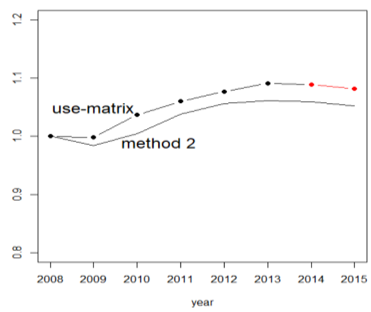

Figure 1 Price indexes for intermediate costs (base year 2008; estimates: red)

Operating costs at 2008 prices are computed by adding up the three cost components expressed at 2008 prices. Finally, the implicit price index of operating costs (*ipc*) is derived by the ratio between operating costs at current prices and operating costs at 2008 prices. Table 1 shows all price indexes and *pch*, which is the ratio between *opc* and *ipc.* The values of *pch*, after a weak increase in 2009, are systematically lower than one, showing that the change of input costs is not compensated by an adequate change in the price of services, although a weak recovery seems to occur in 2015. Figure 2 shows the time pattern of the actual conversion coefficient k_t and the value corresponding to $pch_{t,0}$=1. In 2015, the gap is not recovered yet, despite a positive trend of hotel arrivals (+15%) and nights spent (+4.5%) between 2008 and 2015.

Table 1 Index numbers of costs and prices (base year 2008)

Year	Intermediate costs (*use table*)	Intermediate costs (*method 2*)	Labour costs	Capital depreciation	Operating costs (*ipc*)	Production (*opc*)	*opc/ipc* (*pch*)
2008	1	1	1	1	1	1	1
2009	0.998	0.984	1.025	1.016	1.009	1.014	1.005
2010	1.037	1.004	1.057	1.034	1.043	1.023	0.981
2011	1.060	1.038	1.083	1.045	1.066	1.045	0.981
2012	1.077	1.056	1.103	1.074	1.085	1.061	0.978
2013	1.091	1.061	1.140	1.073	1.104	1.076	0.975
2014	*1.089*	1.059	1.155	1.080	1.109	1.082	*0.976*
2015	*1.082*	1.052	1.149	1.087	1.103	1.092	*0.990*

Source: our elaboration of ISTAT data. *Italics: estimated values*

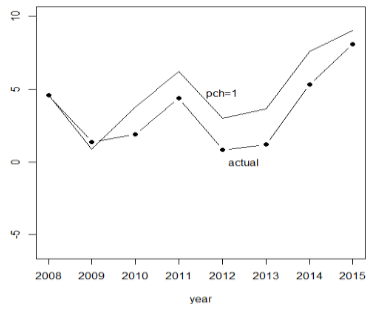

Figure 2 Conversion coefficient of turnover (×100)

3. Results of the quantile regression

The analysis at the micro level, proceeds with the estimation of a function explaining total production, where: total sales *Y* is output and the stock of fixed assets (*K*), labor costs (*L*) and intermediate costs (*C*) are inputs. Data are expressed in thousand Euros at constant 2008 prices. Also the "annual number of nights spent in hotels and similar accommodation facilities" (*N*) is included as it reflects the trend-cycle of the sector in Italy. Furthermore, we have decomposed labor costs into two terms: (1) number of workers, as a measure of labor quantity (*W*); (2) average cost per worker, as a proxy of labor quality (*Cw*), where $L=W\times Cw$. The model (Model 1) with fixed effects is:

$$lnY_{it} = \beta_0 + \sum_{j=1}^{n-1} I_j\ \alpha_j + \beta_1 lnK_{it} + \beta_2 lnW_{it} + \beta_3 lnCw_{it} + \beta_4 lnC_{it} + \beta_5 lnN_t + u_{it}$$

where *i* is the single unit (*i*=1,…, 3058), *t*=2008,…,2015 is time, α_j is the individual fixed effect, I_i is a 0-1 dummy variable assuming 1 for *j*=*i*, and u_{it} is the error component.

The model is estimated through the quantile regression (QR). Each QR parameter β expresses the change in a specific quantile of the response variable produced by one unit change in the regressor, with the other model covariates taken constant. With QR, we can observe how some quantiles of *logY* may be more affected by certain predictors, than other quantiles. The presence of a large number of individual fixed effects can significantly inflate the variability of parameter estimators. Regularization and shrinkage of such effects are applied, by using the R *rqpd* library, with standard errors estimated by bootstrapping methods (Koenker, 2004).

Figure 3 illustrates the parameter estimates for the 9 quantiles, and related 95% confidence intervals, while Table 2 shows the estimated values of parameter for some quantiles. Figure 3 and Table 2 are quite revealing in several ways. Almost all parameter values are highly significant (excluding the intercept for the 0.1 quantile) and vary across quantiles. Only the *lnC* coefficient (β_4, not plotted) shows a stable pattern around 0.65.

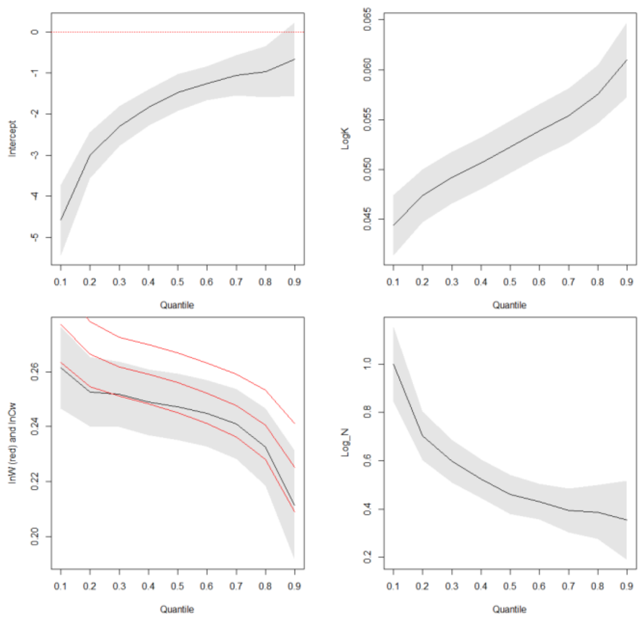

Figure 3 Estimated parameters and 95% confidence intervals

The effect of the variable expressing cycle-trend (*lnN*) is significant with a decreasing pattern over quantiles. It means that aggregate tourist demand affects to a greater extent smaller hotels (lower quantiles of sales), that reveal to be more sensitive to market dynamics.

As the size of the firm grows, the role of capital is increasingly greater whilst the opposite occurs for labor, because both related parameters (β_2 and β_3) exhibit the same decreasing pattern across quantiles. The alternative model (Model 2), with the sole variable *lnL* (in place of *lnW* and *lnCw*) produces similar results (Table 2). Larger firms result less sensitive to labor costs, probably because high skill services are outsourced, or shared within the hotel chain. Finally, if we consider the coefficients attached to the production factors, quasi-constant returns to scale emerge at each quantile.

The most important limitation of the work lies in the fact that information about the quality level of the hotel is not considered. A natural progression of this work is to provide data about hotel category and, possibly, number of rooms, even though it probably will determine a reduction of the dataset size.

Table 2 Results of the quantile regression for 0.1, 0.5, 0.9 quantiles

	Model 1			Model 2		
Covariate	Value	Std. err.	t-value	Value	Std. err.	t-value
Intercept[0.1]	-4.581	0.438	-10.464	-4.655	0.483	-9.633
lnK[0.1])	0.044	0.002	28.687	0.044	0.001	35.957
lnW[0.1]	0.277	0.007	38.969	-	-	-
lnCw[0.1]	0.261	0.008	34.524	-	-	-
lnL[0.1]	-	-	-	0.271	0.007	39.992
lnC[0.1]	0.658	0.006	103.069	0.660	0.006	103.382
lnN[0.1]	0.992	0.079	12.584	1.000	0.087	11.427
Intercept[0.5]	-1.476	0.227	-6.503	-1.461	0.239	-6.105
lnK[0.5]	0.052	0.001	39.223	0.052	0.001	48.405
lnW[0.5]	0.256	0.006	46.099	-	-	-
lnCw[0.5]	0.247	0.006	40.088	-	-	-
lnL[0.5]	-	-	-	0.252	0.005	45.992
lnC[0.5]	0.651	0.005	127.818	0.652	0.005	127.154
lnN[0.5]	0.466	0.041	11.361	0.461	0.043	10.635
Intercept[0.9]	-0.668	0.457	-1.463	-0.661	0.435	-1.520
lnK[0.9]	0.061	0.002	31.998	0.061	0.002	35.049
lnW[0.9]	0.225	0.008	27.571	-	-	-
lnCw[0.9]	0.211	0.010	20.900	-	-	-
lnL[0.9]	-	-	-	0.220	0.008	28.316
lnC[0.9]	0.654	0.007	90.088	0.655	0.007	95.963
lnN[0.9]	0.360	0.083	4.324	0.354	0.079	4.485

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