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INPUT-OUTPUT PRICE MODEL AS AN ANALYTICAL TOOL FOR HOTELS: THE CASE OF A BUSINESS HOTEL IN SPAIN

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Input-Output price model as an analytical tool for hotels: the case of a business hotel in Spain

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ABSTRACT

This article applies the input-output price model to assess the economic impact of changes in the cost structure of a hotel. We use the cost structure that emerges from the enterprise input-output table to define the price model of the operational departments of the company. This price model, together with a calibrated iso-elastic demand function helps to analyse the effects of changes in the cost structure of the hotel on its own prices, its gross operating surplus and its sales. We employ the financial and accounting data from a Galician (Spain) business hotel for the year 2012. To the best of our knowledge, this is the first time that an input-output price model has been applied to a hotel enterprise input-output table. The model presented can be easily expanded to cope for analogous simulations for hotel chains that need to take pricing decisions considering the different cost structures of their hotels.

Key Words: Enterprise input-output, Input-Output price model, Hotel Costs, Gross operating surplus

1. - INTRODUCTION

Spain is one of the world top destinations in terms of international visitor arrivals. Among the different services demanded by tourists (restaurants, accommodation, transport, leisure, etc.), accommodation services are one of the most relevant in economic terms. In 2017 the Spanish hospitality sector represents 18% of total service sector production (INE, 2019) and the accommodation sector a 33.7% of the hospitality production. Moreover, in 2016 Spanish accommodation production accounts for 12.3% of total production of the accommodation sector for the European Union, (Eurostat, 2019). Hence, studying the economic behaviour of the companies in the accommodation sector is crucial for the Spanish economy.

At the European level, in 2018, Accommodation and food services represent 2,9% of the total gross value added at current prices of EU 27 in 2018 (Eurostat, 2020). Moreover, in 2007 for EU 27 the accommodation sector's value added at factor costs accounts for 35.5% of the accommodation and food services sector's value added at factor cost for the EU 27 and 40.4% at the Spanish level.

Among the different economic variables that affect a company, variables related to cost management are one of the most relevant for managers of any type of company. In the case of hotels, the relative presence of fixed costs is very high; therefore, managers must perfectly understand the behaviour of hotel variable costs to maximize their profits.

Initially, cost analysis was used to set room prices but this approach has been criticized because it ignores market conditions as disposable income or substitution effects. Moreover, the high fixed cost structure and the difficulty of tracing costs, make managers concentrate on capacity of utilization rather than cost, (Brignall 1997). The alternative to cost analysis is the market based pricing or revenue management, where prices adjust attending to the demand (Steed and Gu, 2005). In particular, revenue management approach differentiates customers attending to their price sensitivity and applies restrictions related to the period of stay or discounts attending to the type of customer. Another characteristic of this technique is that it is more frequent when a short run perspective determines decision-making (Mattimoe and Seal, 2011). Nevertheless, recently some companies implemented low cost business strategies avoiding complex tariff structures, (Meissner and Strauss 2010).

The purpose of this paper is to analyse the sensitivity of hotel costs to input prices. This will allow managers identify the inputs that have a higher influence in their costs and

adapt their economic decisions to changes in input prices. The analysis applied, the Input Output (IO) approach, does not intend to substitute other methodologies used in hotel planning, but to complement them and help managers undertake decisions, which usually require more than one analytical tool. Input-output is combined with a simple demand function in order to capture the demand side of the problem.

Literature Review

This paper employs the Input Output methodology to analyse the impact of changes in factor prices on hotel total costs and production prices. This technique has its origin in the initial work of Leontief (1936) that presents the flow of materials and factors among the different sectors of an economy assuming that the requirements of inputs and primary factors are independent of prices and vary in fixed proportions to the production level.

The IO technique is less costly, time consuming than other methods as activity based costing, and is relatively easy to apply (Krishnan 2007). Usually, the IO approach is employed to estimate the economic impacts of changes in final demand in a region or country. However, many studies apply input-output analysis at the business level using enterprise input-output (EIO) tables and models. EIO models are useful to complement the managerial and financial accounting systems of firms. Managers could employ EIO to understand the economic flows from suppliers to users, to compare their production structure over time and with other firms, to estimate output and market shares, the direct and indirect requirements and the environmental impact of the firm.

Correa and Correa (1996) employ EIO to analyse the number of persons required and their distribution on the different departments of a library after a change in the demand of different services. Their analysis shows the potential effects of a change in the demand for services by patrons, other libraries, vendors, etc. Moreover, Correa and Craft (1999) generalize the EIO analysis of personnel requirements for any kind of firm. An application of this model is the paper of Correa and Parker (2005) where they analyse the allocation of human, financial and physical resources in a hospital.

Han, Yoo, and Kwak (2004) employ EIO to study four electric power industries employing the demand-driven and supply driven models. They model the impact of electricity supply investment, a shortage in electricity supply and the effects of a rise of electricity rates. Wang and Tong (2007) employ enterprise input output to analyse the transportation costs of a dispersed supply chain. Grubbström and Tang (2000) make an

overview of the use of EIO models to analyse multi-level, multi-stage production inventory systems.

Marangoni and Fezzi (2002) rearrange the Profit and Loss account of a pharmaceutical company as an EIO table to forecast final demand effects on internally shared services and total production, on the production of strategic areas, and finally, the effects of sales variations on profits. They show how the input output model complements "cost drivers" system to monitor and measure internal shared services interdependencies.

EIO analysis is also employed to evaluate enterprise sustainability. Matsumoto and Fujimoto (2008) employ EIO to categorize the different companies producing information and communication technology products attending to CO2 emissions caused by their sales. Kuhtz et al. (2009) compare energy and material use and their greenhouse gas emissions at two tile manufacturers, one in Italy and the other in China. F. Wang and Jia (2012) develop a model to analyse waste reduction and Jia et al. (2015a), employ EIO to analyse material metabolism and waste recycling of a coalmine. Another example is Yazan et al. (2011) where they study a sunflower-based bioenergy production chain. Fraccascia, Albino, and Garavelli (2017) use EIO to measure efficiency of the production processes related to a company from the construction sector. In particular, they try to reduce the waste exchange mismatch between the demand and supply.

Lin and Polenske (1998) show how EIO can be used to support analytical tools as structural analysis, process analysis and environmental management. Their model results from a steel and coke firm and they conclude that the flexibility of the model and the data already available for most of the firms allow the implementation of this type of model in different types of firms.

Lenzen, Benrimoj, and Kotic (2010) and Manrique-de-Lara-Peñate and Langa-Seva (2009), apply IO at firms that supply several services. In particular, Lenzen, Benrimoj, and Kotic (2010) apply this technique to the University of Sidney. They use the input output model to forecast the economic effects caused by changes in the demand for courses. They employ the IO demand and supply models to evaluate the effects of changes in wages.

Manrique-de-Lara-Peñate and Langa-Seva (2009) implement changes on different segments of hotel's demand and analyse the effects of changes in the length of stay on hotel Gross Operating Surplus. Their methodology for the preparation of the EIO table for a hotel has been followed in the preparation of this work. Alternatively, to this demand analysis, input output analysis can be applied to estimate the effects on prices from a

change in the cost of the intermediate inputs, primary factors, taxes or profit rates. This price model assumes fixed technical coefficients, as the demand model does.

The present article employs the IO technique to identify the main determinants of hotel final costs, the interdependencies among the different inputs employed by its departments using an EIO price model. The article identifies the effects of a change in labour input costs on hotel prices, sales and gross operating surplus.

Next section presents a basic description of the hotel. Section three describes the model and the results obtained. Finally, section four, concludes with the main findings and potential further developments of the study.

2. – DESCRIPTION OF THE DATA

The hotel studied belongs to a big Spanish hotel chain with 5 floors, 68 rooms and 1 suite. Moreover, there is a restaurant, a bar, a terrace and a gym. Attending to the financial data available and to the relevance of the transactions, we considered the following number of categories: 55 third-party goods and services, 7 departments, 7 own goods and services (one for each department), 2 tax elements, 10 labour payment items and 1 gross operating surplus account. Therefore, the origin table has 62 rows and 8 columns, and the destination table has 75 rows, and 9 columns. Annex-1 shows details about the concepts behind these categories. Due to its size, the complete origin and destination tables of the enterprise input-output table cannot be included in this paper.

Hotel departments are divided among operational and non-operational ones depending on whether they directly generate earnings for the hotel. The four operational departments (rooms, restaurant, mini-bar and other services) produce the services sold to final costumer so they are measurable and easy to identify. On the other side, non-operational departments (sales department, management and maintenance) produce services that are part of the hotel structural functions, hence they need to be assigned to the operational departments according to the internal cost accounting standards of the firm and they do not directly generate any gross operating surplus (GOS). They can be clearly considered part of the operational department costs. Therefore, any change in the costs of the non-operational departments will always have an impact on the prices of the operational ones. Total turnover and value added of the hotel consist in the value of total production and value added of the operational departments respectively.

The first row of Table 1 shows the value of total production (in €) of all the hotel departments. It corresponds to the total of the Departments' columns of the destination table. Rooms division represents the highest share of total production, 63.5%, followed by the Restaurant with a 12.5%, Other services have a much lower relative presence and the Mini-bar, as it could be expected, is almost irrelevant. These results confirm the standard characteristics of a business hotel where most of its guests just stay there during the night.

Table 1 also shows the hotel cost structure. Naturally, the higher the labour intensity of the department, the lower the capacity to generate GOS. The high relative importance of labour costs for the Restaurant makes it very sensitive to any increase in labour costs. On the other side, Other services (parking, phone and internet access, meeting room renting and laundry) generate the highest rate of GOS. We have to keep in mind that we are considering only direct labour linked to each department. Since operational departments are considered to use the output of the non-operational ones, part of the own intermediate inputs of the operational departments actually consist of labour hired by the hotel to support the non-operational activities. Labour costs include fixed and variable wages, social security contributions, re-billing and different extras. Fixed wages are the main component of all of them.

Table 1: Total production (in €) and cost structure by department

	Rooms	Restaurant	Mini-bar	Other services	Sales	Management	Maintenance
Production	996,712.3	196,218.8	479.3	59,084.32	96,028.7	89,804.5	130,249.55
External Intermediate Inputs	18.0%	32.2%	21.3%	13.3%	84.8%	30.7%	85.5%
Own Intermediate Inputs	31.4%	2.4%	13.0%	0.8%	0.0%	0.0%	0.0%
Taxes	3.2%	0.3%	1.9%	0.1%	0.0%	0.0%	0.0%
Labour	23.1%	61.7%	48.0%	0.8%	15.2%	71.0%	14.5%
GOS	24.3%	3.4%	15.7%	85.1%	0.0%	-1.7%	0.0%

Intermediate costs are those associated with goods and services required by operational departments to produce their own goods and services. They are divided between goods

and services acquired externally (external intermediate inputs) and those generated by the hotel (own intermediate inputs). Intermediate costs are quite sensitive to demand changes while value added is more rigid and does not adapt as fast to changes in demand. Table 2 shows only the most representative intermediate costs over total intermediate cost of each operational department. Rooms division intermediate consumption is dominated by trade agencies commissions with 40.3%, followed by agency rappels and laundry services with 16.8% and 17.2% of total intermediate costs, respectively. As could be expected the restaurant is highly dependent on the consumption of Food and beverages, 90.2% of its intermediate consumption. In the case of Mini-bar and Other services, the former has its intermediate costs divided into Food and beverages and restaurant services; the latter, , mostly consumes internet and Wi-Fi and there is a relevant presence of Equipment rental and Phone services.

Table 2: Main External Intermediate costs by operational department (Percentage over total external intermediate costs)

	Rooms	Restaurant	Mini-bar	Other services
Agency commissions	40.3			
Agency rappels	16.8			
Customer support	6.2			
Food and beverages	2.6	90.2	34.6	
Kitchen supplies		1.3		
Cleaning products	1.5	1.9		
Restaurant supplies			29.0	
Laundry	17.2			
Other professional services			33.3	
Equipment rental				18.0
Internet/Wi-Fi				66.7
Customer phone services				13.1

3. - THE INPUT-OUTPUT PRICE MODEL AND ITS RESULTS

3.1. – The price model

Once the EIO table is prepared a simple short-term price model can be easily undertaken. Details on the preparation of this price model based on input-output methodology are described in Miller and Blair (2009). We assume that technical and value-added coefficients are constant. This EIO-based price model allows estimating the impact on the price of services provided by each operational and non-operational department. We

also assume that the hotel does not operate under full capacity; therefore, the resulting demand after the price change will define the new production level.

The model has two independent but closely related parts. The first one defines the system of equations defining P_j, the final price index by department j using the input-output price model. These prices are determined by the unitary price index of the external goods and services employed pi_i, the unitary price index of the own goods and services employed P_j, the unitary labour cost index w_r, the unitary tax index $tx_{t,j}$ and the price index representing the remuneration of capital (Gross Operating Surplus), pk. Lower case letters represent parameters and variables are represented with uppercase ones. In this model, the variables alternate between P_j and $\propto_j$ which is a variable that adjusts the remuneration of capital (GOS) for department j. If we treat P_j as a variable, α_j is kept fixed to 1. If we keep P_j fixed, $\propto_j$ is considered a variable.

$$P_j = \sum_{i \in e} \left(a^e_{i \in e,j} * pi_{i \in e}\right) + \sum_{i \in o} \left(a^o_{i \in o,j} * P_j\right) + \sum_t \left(tx_{t,j} * P_j\right) + \\ + \sum_r as_{rj} * \left(1 + tcss_j\right) * w_r + \propto_j * ak_j * pk \quad (1)$$

Where:

- j = departments {1…7}; departments 1 to 4 correspond to the operational departments, and 5 to 7 non-operational departments
- i = goods and services {1 …62}
- e = external goods and services. It is a subset of set i {1 …55}
- o = own goods and services. There is one element for each department. It is a subset of set i {56….62}
- r = labour type {1…,10}
- t = tax figures {1,2}
- a_{ij} = quantity of good or service i, required per unit of production of department j
- as_{rj} = unitary labour requirement of type r per unit of production of department j.
- $tcss_j$ = social security contributions per unit of production of department j.
- ak_j = GOS per unit of production of department j.

The second equation defines production of the different departments to be equal to an iso-elastic demand by department j, that is a function of P_j.

$$PRO_j = \overline{DA_J} * \left(\overline{P_j}/P_j\right)^{\sigma} \quad (2)$$

Where:

PRO_j = production level of department j,

$\overline{DA_j}$ =initial level of demand of the services provided by department j,

σ = constant price elasticity of demand,

$\overline{P_j}$ = benchmark price index level for department j

These equations summarize the economic equilibrium for this hotel. We assume a perfectly elastic Leontief production function. The price model allows us to calculate the supply price for each department's goods and services. Once we know this price, we can calculate the resulting demand for this good or service, considering the demand price elasticity chosen. In this model, the quantity produced is totally demand driven.

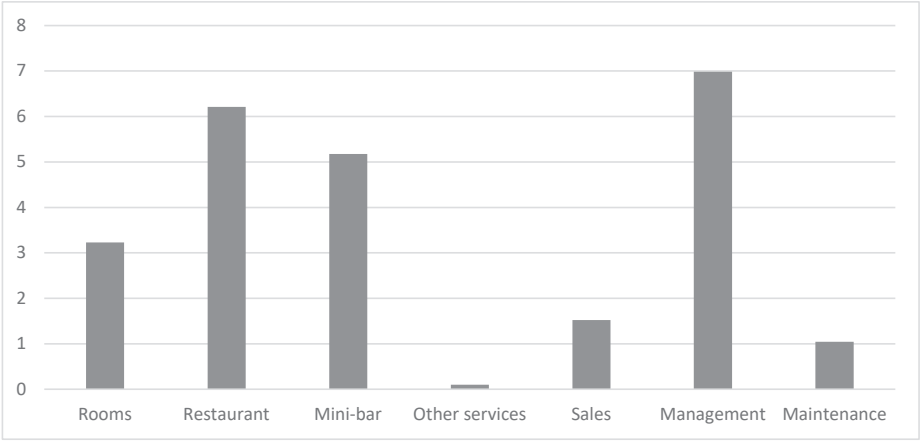
To face a change in the costs of the hotel, the manager has two possible alternative reactions. Either the manager decides to pass this increase in costs over to their clients or they can decide to keep the hotel prices for the own goods provided unchanged, accepting therefore an adjustment of the GOS generated by the hotel. We name the first policy fixed prices and the second one "flexible-prices". We have to bear in mind that the first alternative is not neutral to the GOS generated by the hotel since the increase in prices will end up with a reduction in demand, supply and therefore the level in GOS. The best alternative in terms of GOS will necessarily depend on the level of the price elasticity of demand.

To end the section, we need to point out that to decide which price elasticity to use, we reviewed the literature looking for estimations that could be relevant to the context of Spain in general and Galicia, where the hotel is located, in particular. The range of estimates is wide (González-Gómez et al. 2011, Song et al 2000, Garín-Muñoz 2009, Kulendar and Witt 2001); therefore, this article employs a similar range of elasticities. The actual values considered in the simulations for the price demand elasticities are: -0.05, -0.5, -0.9, -1, -1.2, -1.5, -2 and -3. These elasticities apply similarly to all the different services provided by the hotel, since we do not have estimations for particular elements of its supply.

3.2. – The simulations

The impact modelled in our simulations is incorporated by exogenously increasing the hotel labour costs. All the categories related to labour payments increase simultaneously for all the operational and non-operational departments. Under the "flexible-prices" alternative, we can easily calculate the new production prices using the price equation (1). The increase in labour costs translates smoothly into the prices of the different services provided by the hotel. Figure 1 shows the price increases of the all the goods and services provided by the different departments of the hotel when labour costs increase in a 10%. The most affected departments are those more labour intensive (see Table 1). We have to remember that this increase in prices comes not only from the increase in labour costs but also from the fact that now the non-operational departments offer their services to the operational departments at higher costs. Under the fixed prices option, the price of the services provided by the operational departments will stay unchanged, while the change in the prices for the non-operational departments will be the same as in the previous option (Figure 1).

Figure 1: Percentage change in prices by department derived from a 10% increase in labour costs



Under the alternative of flexible prices, demand, and therefore supply, will be affected. Table 3 records this change in the turnover of the hotel for the different values of elasticity.

Table 3: Percentage change in sales by operational department derived from a 10% increase in labour costs

Elasticity	Rooms	Restaurant	Mini-bar	Other services
0.05	-0.17	-0.33	-0.28	-0.01
0.5	-1.73	-3.25	-2.73	-0.06
0.9	-3.09	-5.78	-4.86	-0.10
1.0	-3.43	-6.40	-5.39	-0.11
1.2	-4.10	-7.63	-6.43	-0.13
1.5	-5.10	-9.44	-7.97	-0.17
2.0	-6.75	-12.38	-10.49	-0.22
3.0	-9.95	-17.99	-15.31	-0.33

The impact on sales differs between departments because the impact on prices is also different for each of them, despite the fact that the assumed price elasticity of demand is always the same for all the departments. The biggest impacts are associated to the restaurant and the minibar. The potential explanation for these results is that not only the number of clients is smaller but also that the incoming clients will tend to demand proportionally less.

The impact on the GOS of the hotel depends on the simulation alternative used as explained above. Under the flexible prices alternative the reduction on the GOS comes from the reduction in sales. When using the fixed-prices alternative, the reduction on the GOS comes from the pressure of the increase in operating costs. In this case, there is no pass-through between the prices of intermediates and the final prices of the departments of the hotel, as was actually assumed in the simulation with flexible prices. Therefore, P_j is kept fixed for the operational departments, while α is now the adjusting variable. With no changes in the final prices, there are no changes in demand or production.

Table 4 presents the difference between the GOS under the flexible-prices alternatives and the GOS under the fixed price alternative. The columns reflect the increase in labour costs. Sim-1 indicates a 1% increase in labour costs, Sim-2 a 2% increase and so on. The rows reflect the different elasticities. When considering a price elasticity of 0.5, and a labour cost increase of a 5%, the GOS under the flexible price alternative is a 6.8% higher than in the case of the fixed price alternative.

The main conclusion is that, for the range of elasticities considered, the "flexible-prices" alternative is always better than the fixed prices one. However, the results range from a difference of a 0.7% to almost 15%. This difference clearly grows with the labour costs. Naturally, the higher these labour costs the higher the reduction in the GOS if the prices are constant. On the other hand, the higher the elasticity, the higher the impact on sales

of the flexible price alternative and, therefore the higher its impact on the GOS. When the price increase is small and the elasticity is large, the difference between both alternatives is not very relevant.

Table 4: Comparison between the two alternatives considered (in percentages)

Elasticity	Sim-1	Sim-2	Sim-3	Sim-4	Sim-5	Sim-6	Sim-7	Sim-8	Sim-9	Sim-10
0.05	1.5	3.0	4.4	5.9	7.4	8.9	10.3	11.8	13.3	14.8
0.5	1.4	2.7	4.1	5.4	6.8	8.1	9.5	10.8	12.2	13.6
0.9	1.2	2.5	3.7	5.0	6.2	7.5	8.7	10.0	11.2	12.5
1.0	1.2	2.4	3.6	4.9	6.1	7.3	8.5	9.8	11.0	12.2
1.2	1.2	2.3	3.5	4.7	5.8	7.0	8.2	9.3	10.5	11.7
1.5	1.1	2.2	3.2	4.3	5.4	6.5	7.6	8.7	9.8	10.9
2.0	0.9	1.9	2.8	3.8	4.8	5.7	6.7	7.7	8.6	9.6
3.0	0.7	1.3	2.0	2.7	3.4	4.2	4.9	5.6	6.4	7.1

The interpretation of the results is not always so homogeneous when we differentiate by departments. Tables 5 to Table 8 show similar data for the different departments. The difference between both alternatives is now compared with the initial level of the gross operating surplus of the department. The case of the Rooms department, Table 5, seems to be very similar to the global picture, what is compatible with the type of hotel we are considering in this research. Only for very low labour cost increases and very high elasticities, the prevalence of the flexible-prices alternative is at risk. For the Restaurant, Table 6, the main conclusion is reinforced: the flexible-prices alternative seems always preferable. The high values reached are due to the fact that under the fixed prices alternative and for labour cost increases higher than 5%, the gross operating surplus of the restaurant gets negative.

Table 5: Comparison between the two alternatives considered (in percentages) (Department: Rooms)

Elasticity	Sim-1	Sim-2	Sim-3	Sim-4	Sim-5	Sim-6	Sim-7	Sim-8	Sim-9	Sim-10
0.05	1.3	2.6	4.0	5.3	6.6	7.9	9.2	10.5	11.9	13.2
0.5	1.2	2.3	3.5	4.7	5.9	7.0	8.2	9.4	10.6	11.8
0.9	1.0	2.1	3.1	4.2	5.2	6.3	7.3	8.4	9.5	10.5
1.0	1.0	2.0	3.0	4.1	5.1	6.1	7.1	8.1	9.2	10.2
1.2	0.9	1.9	2.9	3.8	4.8	5.7	6.7	7.7	8.6	9.6
1.5	0.9	1.7	2.6	3.4	4.3	5.2	6.0	6.9	7.8	8.7
2.0	0.7	1.4	2.1	2.8	3.5	4.2	5.0	5.7	6.4	7.2
3.0	0.4	0.8	1.1	1.6	2.0	2.4	2.8	3.3	3.8	4.2

For the Mini-bar, Table 7, the conclusions are similar than for the Rooms departments although the differences observed are always higher. More interesting are the results for Other services department, Table 8. The differences are not only much lower but they go from positive differences to negative ones for elasticities higher than 1.5, making the fixed prices alternative preferable. The values are very low for this business hotel, but this may not be the case for tourism hotels were the entertaining activities are more important.

Table 6: Comparison between the two alternatives considered (in percentages) (Department: Restaurant)

Elasticity	Sim-1	Sim-2	Sim-3	Sim-4	Sim-5	Sim-6	Sim-7	Sim-8	Sim-9	Sim-10
0.05	18	36	54	72	90	109	127	145	163	181
0.5	18	36	53	71	89	107	125	143	160	178
0.9	18	35	53	70	88	106	123	141	158	176
1.0	18	35	53	70	88	105	123	140	158	175
1.2	17	35	52	70	87	104	122	139	157	174
1.5	17	34	52	69	86	103	121	138	155	173
2.0	17	34	51	68	85	102	119	136	153	170
3.0	16	33	49	65	82	98	115	131	148	165

Table 7: Comparison between the two alternatives considered (in percentages) (Department: Mini-bar)

Elasticity	Sim-1	Sim-2	Sim-3	Sim-4	Sim-5	Sim-6	Sim-7	Sim-8	Sim-9	Sim-10
0.05	3	7	10	13	16	20	23	26	30	33
0.5	3	6	9	12	15	18	21	24	27	31
0.9	3	6	9	11	14	17	20	23	26	29
1.0	3	6	8	11	14	17	20	22	25	28
1.2	3	5	8	11	14	16	19	22	24	27
1.5	3	5	8	10	13	15	18	21	23	26
2.0	2	5	7	9	12	14	16	19	21	23
3.0	2	4	5	7	9	11	13	15	17	19

Table 8: Comparison between the two alternatives considered (in percentages) (Department: Other services)

Elasticity	Sim-1	Sim-2	Sim-3	Sim-4	Sim-5	Sim-6	Sim-7	Sim-8	Sim-9	Sim-10
0.05	0.01	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.10	0.11
0.5	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.07
0.9	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03
1.0	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.5	0.00	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03
2.0	-0.01	-0.02	-0.03	-0.03	-0.04	-0.05	-0.06	-0.07	-0.08	-0.08
3.0	-0.02	-0.04	-0.06	-0.07	-0.09	-0.11	-0.13	-0.15	-0.17	-0.18

If we believe that the real elasticities are not outside of the range considered in this simulation, the results have a clear implication for this type of hotels: in general, it seems always better to pass the cost increases to the final prices. Obviously, this would not be the case if this were not a general response of all the hotels in the area. If some hotels decide not to pass cost increases on prices, they may get a higher market share overcoming the adverse effects of keeping prices fixed on the GOS.

The multi-departmental aspect of our model helps to differentiate the policy implications. Although only in some cases -due to competitive reactions from other hotel in the area, or to very low cost increases and very high elasticities- the fixed prices options may prove defensible, it seems never a plausible option for departments like the restaurant. For other departments like Other services the fixed price alternative may be the best option even without considering strategies in relation to the competition.

4.- CONCLUSIONS

This article presented an analysis of the operational departments cost structure of a Spanish business hotel. An enterprise input-output table was constructed, and an input-output price model was employed to analyse the different determinants of their costs and the response of several economic variables (prices of services, final demand and gross operating surplus) to changes in its costs. We believe the enterprise input-output tables prepared in this paper could serve as a basis for further and more complete modelling efforts. On the other hand, using multi-department models is useful to differentiate pricing policies at the department level.

Among the different operational departments, the restaurant stands out as the department with the highest level of dependency on these inputs but its effect is also present on the remaining departments: rooms division, the mini-bar and other services. The best pricing strategy heavily depends on the demand elasticity. In the case of the restaurant, the best alternative to overcome a potential change in the price of intermediates will be an increase in the prices of the services supplied. For other department, a sufficiently high elasticity could end up making more advisable to keep prices fixed. The conclusions achieved also heavily depend of the type of hotel analysed in this research: a business city hotel.

Naturally, we do not pretend that the results obtained are generalizable to any other hotel. However, we believe that the strategy undertaken could be adapted to any other type of hotels. The preparation of these enterprise input-output tables has been very time

consuming. However, we are convinced that, if a hotel decides to elaborate such a table it should not be a very costly effort, since the information is readily available in its databases. Just a combination of these data is needed to build the enterprise input-output table and, once the software application is ready, it is just a question of maintenance to have the enterprise input-output table and models available. We have to bear in mind that just updating these enterprise input-output tables gives the opportunity to managers to easily follow the evolution of the cost structure of their companies.

To the best of our knowledge, this study is the first step to implement a price model using an enterprise input-output model of a hotel. The study could be extended in different ways; firstly, optimization models could be prepared where other restrictions could be implemented, like keeping the GOS above a certain nominal value. Secondly, the hypothesis of fixed technical coefficients could be partially relaxed for some of the intermediate inputs and factors employed. This enhancement would require a deeper analysis and modelling of the production functions used. Thirdly, the demand function employed to estimate the effects of changes could be transformed from its deterministic functional form to a stochastic one to include probabilistic behaviour of customers. Finally, the elasticity of demand could vary among the different departments to allow for different responses by department after the same relative change in the input costs or factor costs. All of these proposed enhancements amplify the need to undertake the estimation of demand and cost functions at the firm level.

Without pretending that this type of model is the only option to analyse this type of impact on the costs of a hotel, we think that the enterprise input-output tables prepared in this paper could serve as a basis for further and more complete modelling efforts. Using multi-department models at the company level can be useful for many types of analysis of interest to managers. We hope to have proven its usefulness to differentiate pricing policies at the department level.

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Annex-1

	External goods and services
1	Water
2	Electric power
3	Diesel fuel
4	Equipment rental
5	Management printers
6	Commissions on liner group agencies
7	Commissions cards
8	Data communications
9	Management fee
10	Opera support
11	Outsourcing service
12	Premium insurance p & b
13	Sales office & group
14	Insurance
15	Marriott insurance
16	Other services
17	Your attention
18	Lingerie
19	Kitchen materials
20	Laundry materials
21	Cleaning materials
22	Uniforms
23	Winery and others
24	Office material consumption
25	Restaurant
26	Office supplies
27	Electric material
28	Miscellaneous material
29	Medicine at work
30	Wi-Fi Internet
31	Customer phone cost
32	Mobile phone cost
33	Travel expenses
34	Transportation expenses
35	Hosting opera & symphonic orchestra
36	Main Maintenance operations
37	Various maintenance
38	Legal maintenance
39	Other professional services
40	Customer press
41	Promotion
42	Advertising
43	Personal phones
44	Legionella treatment
45	Other hotel chains
46	Elevators
47	Laundry Dry Cleaner
48	Other software maintenance
49	Software's applications maintenance
50	Electric repairs
51	Other hotel points
52	Personal training
53	Rappels travel agencies
54	Rappels other agencies
55	Various

	Own goods and services
1	Rooms services
2	Restaurant services
3	Mini-bar services
4	Other services
5	Sales activities
6	Management activities
7	Maintenance activities

	Departments
1	Rooms
2	Restaurant
3	Mini-bar
4	Other services
5	Sales
6	Management
7	Maintenance

	Tax concepts
1	Production taxes
2	Indirect axes

	Staff costs
1	Social security
2	Fixed remuneration
3	Variable compensations
4	Personal re- billing
5	Proportional extra hours
6	Variable pluses
7	Nightlike plus
8	Transport plus
9	Compensations
10	Other personnel expenses

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