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**ENTERPRISE INPUT-OUTPUT TABLE FOR A HOTEL**

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# Enterprise Input-Output Table for a Hotel

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## ABSTRACT

The purpose of this study is to prepare an enterprise input-output economic accounting framework for a hotel together with a demand model associated with it. This paper aims to show how input-output methodology can be applied at the business level in the tourism sector. This study is based on input-output tables and models. We have adapted the input-output framework to the characteristics and needs of a hotel in order to build an enterprise input-output table. This table is then used to apply the input-output demand model to changes in the hotel demand structure.

Financial accounting systems are not especially enabled to link the demand and supply behaviour of the firm, but they can be used to build enterprise input-output tables and models that are perfectly suited for this aim. With this framework, economic impact analysis at the enterprise level can be undertaken in the tourism sector.

This type of framework helps to prepare impact models at the enterprise level either isolated or integrated in revenue management, environmental, life cycle analysis (LCA), micro-simulation, partial or general equilibrium models. To the best of our knowledge, this is the first time such an effort has been undertaken in the hospitality sector.

**Keywords:** Economic impact models, Enterprise input-output, Hotel economic model, Input-output demand model

**JEL codes:** C67, D22, D57, M11, M21, P42, Z31

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# 1-INTRODUCTION

Input-output models have been and are still widely used in economic impact analysis of tourism. However, most of this analysis has been done at the level of the whole economy or region and not just focusing on concrete tourism-related enterprises. Furthermore, most of this input-output research has been mainly oriented towards the demand side of tourism activity. This work aims to incorporate the production side of the hospitality sector in tourism economic analysis in a more visible way.

In this research, we prepare an economic accounting system for a tourism business based on an input-output framework. This scheme is especially useful to describe the existing interrelations between the different departments of a firm. To the best of our knowledge, this is the first time such an effort has been undertaken in the hospitality sector.

Putting together information on the cost structure and demand at the firm level facilitates the preparation of useful simulation models in the same way as in the case of an economy as a whole. Enterprise input-output tables allow to present the interdependencies that exist in a firm's production activities in relation to the demand satisfied and therefore give us the opportunity to articulate, under certain conditions, economic and environmental business simulation models. In other words, economic accounting and models can be used by business managers to simulate the economic impact of their potential decisions.

The models we are referring to consist in models related to demand and price input-output models together with models based on mathematical programming. We should also consider the possibility of incorporating this much more detailed description of hospitality firms into more general economy-wide partial or general equilibrium economic models. Revenue management decisions constantly need the recalculation of economic surplus or benefits. This enterprise input-output model could also be integrated into the core of these calculations.

The paper starts with a review of the literature relating to input-output and tourism and to enterprise input-output. We then present our proposal of adapting the input-output framework to the hospitality sector at the firm level. After a section describing how our table was built, we proceed to describe the demand model we apply as an example. The final section discusses the different opportunities opened with such an accounting framework for the field of tourism economic analysis.

## 2- LITERATURE REVIEW

### 2.1.- Input-Output and Tourism

Leontief (1936) introduced input-output analysis in 1936. Archer (1977) contributed one of the first applications of impact analysis for the tourism activity using input-output multipliers, considering the pros and cons of this type of models. Various authors have reviewed the different applications offering also a critical view on the use of the input-output related models in impact analysis of tourism activities.

Fletcher (1989) reviews the advantages and disadvantages of using input-output analysis to measure the economic impact of tourism. The comprehensive description of the economy, the capacity to consider inter industry links, the possibility to use ad hoc sectoral aggregations and the ability to evaluate three levels of impact -direct, indirect and induced- are cited by the author as the main advantages of these models. Most of these advantages are still used in recent contributions like the ones by Carrascal Incera, Fernández Fernández, & Pereira López (2015) and Pratt, (2015)

Most of the applications use the demand model, but there are also studies using the price model in the context of the tourism sector. This is the case of Logar & Van Den Bergh (2013). Input-output demand models have been also used for the calculation of the economic impact of special tourism related events. Lee & Taylor (2005) and S. N. Li & Jago (2013) represent valuables example of events' evaluation. More recent efforts include the combination of input-output and network analysis techiniques (Zha, Shao and Li, 2019)

Tourism and input-output tables and models appear together in many research efforts related to environmental issues. This is the case of the work undertaken by Lenzen et al. (2018) to calculate the carbon footprint of global tourism. Sun (2014) combines the use of tourism satellite accounts with an environmentally extended input-output model to calculate the direct, indirect and induced effects that are due to tourism demand. Sun (2016) adds structural decomposition analysis to the previous effort.

Los & Steenge, (2010) make a broad interpretation of input-output analysis since they do not limit its area of influence to the static open Leontief model and describe the area of tourism-input-output as a 'blossoming field' of study. They identify a series of relevant pieces of work in the area of tourism related to impact analysis that use input output methodology.

It is clear that there are many ways to approach the analysis of the economic impact of tourism. However, whatever the model type, in one way or the other, most seem to rely in input-output tables and data. A good example of these different ways to approach the same reality is the case of the research done by Polo & Valle (2008), Polo & Valle (2016) and Soulie & Valle (2014). These authors study the tourism in the Balearic Islands under different perspectives using regional input-output tables, social-accounting-matrix multipliers and a computable general equilibrium model. The three models should not be considered excluding alternatives but different complementary ways to use input output tables in the analysis of tourism activities.

**2.2.- Enterprise Input-Output**

Multisector models like the input-output model have been mainly used at the national and regional levels. An exception of great interest can be found at Zhang, Ding, & Bao (2008). However, there is another line of work in the area of input-output analysis that places emphasis purely on the business scope. This work tries to implement such an analysis for a hotel. But first, we will put this type of approach into perspective.

As early as in 1954, Redman (1954), although not defining a complete enterprise input-output model, recognized the importance of input-output data at the single firm level in the decision-making process. Richards (1960) illustrates the parallels between the input-output model and enterprise accounting. Farag (1968) concentrates on the production side of the firm, taking into consideration the specification of the flows between the different departments of the firm. Although the representation is quite synthetic, his model perfectly mimics the standard input-output table and model.

Badi (1979), in his PhD dissertation, applies the input-output methodology to the planning of the operations of a refinery. Li (1981) presents a similar application related to steel and iron combined enterprises. Neither of these authors includes the use of factors of production, thereby concentrating only on the direct and indirect intermediate demand of the different processes. Polenske (1997) reviews and compares different more classical accounting systems with the one originating in the input-output accounts, showing the advantages of the latter.

Various examples of the use of enterprise input-output in environmental and sustainability analysis can be given. Matsumoto and Fujimoto (2008) model the CO2 flows of a group of Japanese electronics enterprises using enterprise input-output both at the micro and national level and demonstrate the need for companies to cooperate in order to implement successful

abatement policies. Kuhtz, Zhou, Albino, and Yazan (2009) used this framework to compare two different tile manufacturing companies, one located in China and the other in Italy. Wang and Jia (2012) propose the extended enterprise input-output model for sustainability. This model combines enterprise input-output with process integration, in particular with pinch analysis techniques. This helps in the analysis of energy, water and mass flows within the firm. Other aspects of enterprise management have also been studied under the umbrella of enterprise input-output. V. Albino, Petruzzelli, and Okogbaa (2008) combine an enterprise input-output table for the description of production processes and the spatial representation of all the logistic flows implied by these production processes. In another context, J. Li, Tong, and Wang (2008) expand enterprise input-output to include the regional location of the firms, theoretically defining what they call 'trans regional enterprise input-output' Q. X. Li, Liu, and Lin (2012) apply enterprise input-output to conditions of uncertainty. Grey system theory is applied to solve this system coupled with the uncertainty of the data. The results achieved are no longer point estimates but ranges of total output or intermediate demand. Tan et al. (2016) apply the concepts of fuzzy linear programming in this context to help decision-makers to adjust to situations of resource shortages. The model is applied to an aluminium industrial complex in order to consider climate change adaptation to water scarcity. Fraccascia, Albino and Garavelli (2017) propose technical efficiency measures of industrial symbiosis networks, using EIO, which help revealing any mismatches between supply and demand of waste.

Enterprise input-output has mainly been applied to the manufacturing sector, but not exclusively. Other sectors treated include the mining sector (Liang, Jia and Zhang, 2011), the pharmaceutical industry (Marangoni and Fezzi, 2002), a city's municipal governments (Correa and Guajardo, 2001), universities (Lenzen, Benrimoj, & Kotic, 2010), hospital management (Correa and Parker, 2005), dairy products (Lenzen and Lundie, 2012) and societal systems (Correa, 2002), among others.

Based on our knowledge, enterprise input-output has not been applied yet to the tourism sector. We believe many of the research lines described in this literature review, like environmental related impact analysis, could be applied to the tourism industry, thereby significantly widening the economic analysis possibilities of tourism activities. In this paper, we develop a basic open enterprise input-output table for a hotel as a first step towards expanding the enterprise input-output related research associated with the hospitality sector.

## 3.- ADAPTING THE INPUT-OUTPUT FRAMEWORK TO HOSPITALITY ENTERPRISES

### 3.1.- The basic Input-Output Framework

Input-output tables use a quite compact accounting scheme to describe the relationships between productive units in an economy. Thus, the present structure and future projections of an economy can be easily analysed. Naturally, we have to keep in mind that the quality of the information and the opportunity of the fixed technical coefficient conditions implicit in the IO model, can strongly condition its relevance.

Both the 1993 (Commission *et al.*, 1993) and the 2008 Systems of National Accounts (United Nations et al., 2009) describe the supply and use tables as the founding ground of input-output tables. After the introduction of these systems of accounts the input-output table was represented as the 'input-output framework', constructed putting together a set of interconnected matrices. These tables can be classified as origin and destination tables, the combination of both and symmetric input-output tables. In our enterprise economic model we will be concentrating on the accounts related to the production process and the demand for the production of the company. We shall therefore concentrate our efforts on the adaptation of the origin and destination tables.

The origin input-output table included in the input-output framework reflects the value of the total amount of goods and services available in the economic system. Domestic supply is complemented by the imports of goods and equivalent services. The total supply of goods and services at basic prices can therefore be calculated adding together the value of domestic and imported goods and services, valued at basic and CIF prices respectively.

The destination table includes three main matrices. The matrix of intermediate consumption by type of product and sector of activity, the matrix of final demand of the economy and the matrix of value added by branch of activity and type of primary input. The destination table shows how the different goods and services are used in a given economy and deploys the cost structure of the different branches of the economy.

### 3.2.- Enterprise Origin and Destination Tables

Enterprise origin and destination tables should be able to present the same information as the ones at the economy level, but within the boundaries of a single firm. In these tables, we have classified goods and services into 'own goods and services' and 'third-party goods and

services'. The 'own goods and services' are generated by the departments of the firm. The 'third-party goods and services' are products that originate outside the firm. The company buys these goods and services from its suppliers or creditors.

This classification may seem quite similar to classifying goods and services between domestic and foreign. Most economy-wide input-output tables incorporate this distinction. In hotel businesses this differentiation responds to a similar justification. Third-party goods and services are those not produced by the business itself. They will be mainly used as intermediates or as investment goods. Hotels buy beverages (third-party goods) but sell a service called 'Beverages served' (own service). The labour and capital added to the beverages to generate the service is the value added generated with its activity and is the source of the profit of the company. Most 'own goods and services' are directly invoiced to its clients by the firm under study.

The own goods and services include room services, meals, drinks, massage services, etc. Some own goods and services could be used to satisfy both intermediate and final demand (e.g. own laundry). Third-party goods and services could, for example, be fruits and vegetables needed to prepare meals, cleaning material, insurance services, etc. In our enterprise input-output framework, the different activities are named after the departments of the company.

The enterprise origin table reflects, in its rows, both third-party and own goods and services. The own goods and services correspond to the supply of the company, which is mostly provided to the clients. The third-party goods and services are assigned to the warehouse, which will then distribute them to the different departments of the firm. The warehouse account plays a similar role to the Rest of the World in the national accounts of a country or region as a whole. Table 1 presents a simplified enterprise origin table prepared for the respective tourism company.

**Table 1: Simplified enterprise origin table**

| | DEPARTMENTS | WAREHOUSE | TOTAL |
|---|---|---|---|
| OWN GOODS AND SERVICES | Production of own goods and services by departments | | TOTAL OWN GOODS AND SERVICES SUPPLY |
| THIRD-PARTY GOODS AND SERVICES | | Purchases | TOTAL SUPPLY OF THIRD-PARTY GOODS AND SERVICES |
| TOTAL | TOTAL VALUE OF PRODUCTION BY DEPARTMENTS | TOTAL PURCHASES | TOTAL RESOURCES |

Source: own elaboration

The rows of an enterprise destination table show how the different goods and services available in a firm are used as intermediates by the different departments or are sold to the clients. The columns associated to the different departments show the intermediate consumptions needed

by the different departments and the value added generated by them. We can therefore easily identify the cost structure of the different departments and their demand structure. In defining the cost structure, we can go as deep as the cost accounting of the company will allow us. Some hotels have defined perfectly the material contents of each of their menus. Under these conditions, we can easily define as many sub departments for the kitchen department as there are menus.

As can be easily observed, the firm can use both third-party and own goods and services as intermediates. Third-party goods and services are distributed to the different areas of the firm but never directly to the clients. Clients' consumption always consists of 'own goods and services'. In our application, we assume there is no gross capital formation directly generated by the hotel. Table 2 exemplifies a simplified enterprise destination table.

**Table 2: Simplified enterprise destination table**

| | Departments | Final Consumption | Gross Capital Formation | TOTAL |
|---|---|---|---|---|
| Own goods and services | Intermediate consumption of own goods and services by departments | Sales of own goods and services | Fixed Gross Capital Formation and Change in Stocks of own goods and services | TOTAL USES OF OWN GOODS AND SERVICES |
| Third-party goods and services | Intermediate Consumption of third-party goods and services by departments | | Fixed Gross Capital Formation and Change in Stocks of third-party goods and services | TOTAL USES OF THIRD-PARTY GOODS AND SERVICES |
| Value Added | Value Added by departments | | | |
| TOTAL | TOTAL VALUE OF PRODUCTION BY DEPARTMENTS | | | |

Source: own elaboration

## 4.- PREPARATION OF THE ACCOUNTING FRAMEWORK FOR OUR CASE STUDY

### 4.1.- Preparation of the Enterprise Origin Table

We have prepared the 2006 enterprise input-output table of a four-star hotel establishment (207 rooms) located in Fuerteventura (Canary Islands, Spain). The hotel's warehouse keeps track of 3,761 different items, which would need to be considered as third-party goods and services. On the value added side, the company accounts consider 140 items linked to the compensation of employees. The management application of the hotel keeps information about its customers and

their expenditures, but no link is established between the different services of the hotel and any groups of clients. The records of the hotel keep track of 34 items that can be considered as own goods and services.

Part of the information was obtained in a form that could be easily treated to prepare the databases that would allow the combination of all pieces of information. However, we have to keep in mind that hotel management computer programs are normally prepared to ease the administrative procedures, not to facilitate economic analysis or simulation. Because of this, many pieces of the information required (e.g. invoices for each client in our case as image files) had to be treated specifically in order to generate files in readable formats. Anyway, normally most of the information needed to prepare our tables is available through the management and accounting computer applications available in the hospitality establishments in one way or another. The effort to prepare these tables in a more automatic way should be undertaken only once and cannot be considered extremely costly or time-consuming.

Table 3 shows the 3,761 third-party goods and services used by our hotel, conveniently aggregated into 26 categories. It reflects the cell called 'purchases' in Table 1. These are the goods and services used by the different departments of the hotel to be able to generate their services. They also include the goods considered as gross capital investment (change in inventories and fixed investment goods). From the total of 2,256,474.08€ spent, the main items are obviously related to food and beverages, accounting together for 40% of all purchases.

**Table 3 Aggregated enterprise origin table (in € and %): purchases of third-party goods and services**

| Item | € | % | Item | € | % |
|---|---|---|---|---|---|
| Advertising | 214,009.0 | 9.5 | Kitchenware | 6,697.5 | 0.3 |
| Beverages | 211,355.2 | 9.4 | Lingerie | 24,652.1 | 1.1 |
| Cleaning | 77,867.5 | 3.5 | Office supplies | 32,213.1 | 1.4 |
| Communications | 26,537.0 | 1.2 | Other services | 91,061.8 | 4.0 |
| Community charges | 4,077.4 | 0.2 | Professional services | 20,460.8 | 0.9 |
| Customer services | 31,887.2 | 1.4 | Repair and maintenance | 239,611.9 | 10.6 |
| Cutlery | 7,908.7 | 0.4 | Replacement | 1,715.7 | 0.1 |
| Dishes | 11,420.9 | 0.5 | Subcontractors | 125,724.7 | 5.6 |
| Food | 693,455.9 | 30.7 | Supplies | 336,532.1 | 14.9 |
| Glassware | 8,982.5 | 0.4 | Temporary works | 1,050.9 | 0.1 |
| Hotel uniforms | 6,124.0 | 0.3 | Transport | 14,729.5 | 0.7 |
| Insurance | 21,101.2 | 0.9 | Various materials | 47,297.9 | 2.1 |

Source: own elaboration

Table 4 records the own goods and services provided by the different departments. It represents the value of production of the company at factor costs and corresponds to the flows considered in the cell 'Production of own goods and services by departments' in Table 1.

The elaboration of the enterprise destination table can be divided into three main stages: the calculation of the cost structure of the different departments, the presentation of the clients' expenditure, and the balance of total uses and resources of goods and services in the company.

### 4.2.- Preparation of the Enterprise Destination Table

The first stage implies the calculation of the first column of Table 2, which is represented in Table 5.

The procedure can be summarized as follows. The total production or turnover of each department was obtained through the database on invoicing of the hotel. The warehouse of the hotel keeps track of all the third-party goods and services assigned to each department, allowing direct assignment of these intermediate consumptions. In the case of the provision of general services, the corresponding totals were divided between the main departments of the company according to the indications of the hotel administration.

**Table 4 Aggregated enterprise origin table (in €): production of own goods and services by departments**

| | DEPARTMENTS | | | | | | |
|---|---|---|---|---|---|---|---|
| ITEMS | RENTALS | ACCOMMODATION | MINIBARS | CHECK-IN & ADMIN | RESTAURANT | SNACK BAR | TOTAL |
| Accommodation | 0.0 | 3,521,443.4 | 0.0 | 0.0 | 0.0 | 0.0 | 3,521,443.4 |
| Atypical | 0.0 | 0.0 | 0.0 | 2,238.8 | 0.0 | 0.0 | 2,238.8 |
| Beauty | 0.0 | 0.0 | 0.0 | 630.9 | 0.0 | 0.0 | 630.9 |
| Billiards | 0.0 | 0.0 | 0.0 | 841.1 | 0.0 | 0.0 | 841.1 |
| Board | 0.0 | 0.0 | 0.0 | 0.0 | 1,908,142.2 | 0.0 | 1,908,142.2 |
| Cellar bar salon | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 95.0 | 95.0 |
| Clothes spa | 0.0 | 0.0 | 0.0 | 511.8 | 0.0 | 0.0 | 511.8 |
| DVD | 0.0 | 0.0 | 0.0 | 40.2 | 0.0 | 0.0 | 40.2 |
| Extra ticket | 0.0 | 0.0 | 0.0 | 14,834.6 | 0.0 | 0.0 | 14,834.6 |
| Fax | 0.0 | 0.0 | 0.0 | 73.4 | 0.0 | 0.0 | 73.4 |
| Forex | 0.0 | 0.0 | 0.0 | 370.8 | 0.0 | 0.0 | 370.8 |
| Guards | 0.0 | 0.0 | 0.0 | 38.2 | 0.0 | 0.0 | 38.2 |
| Health & beauty | 0.0 | 0.0 | 0.0 | 548.5 | 0.0 | 0.0 | 548.5 |
| Internet | 0.0 | 0.0 | 0.0 | 2,223.6 | 0.0 | 0.0 | 2,223.6 |
| Light | 0.0 | 0.0 | 0.0 | 16.7 | 0.0 | 0.0 | 16.7 |
| Lingerie | 0.0 | 0.0 | 0.0 | 1,684.1 | 0.0 | 0.0 | 1,684.1 |
| Massage | 0.0 | 0.0 | 0.0 | 789.7 | 0.0 | 0.0 | 789.7 |
| Massage à la carte | 0.0 | 0.0 | 0.0 | 1,230.4 | 0.0 | 0.0 | 1,230.4 |
| Massage rentals | 42,071.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 42,071.3 |
| Minibar drinks | 0.0 | 0.0 | 27,305.8 | 0.0 | 0.0 | 0.0 | 27,305.8 |
| Minibar food | 0.0 | 0.0 | 1,558.6 | 0.0 | 0.0 | 0.0 | 1,558.6 |
| Parties | 0.0 | 0.0 | 0.0 | 41,263.9 | 0.0 | 0.0 | 41,263.9 |
| Rest, Beverages | 0.0 | 0.0 | 0.0 | 0.0 | 122,036.7 | 0.0 | 122,036.7 |
| Rest, Bodega | 0.0 | 0.0 | 0.0 | 0.0 | 152,660.5 | 0.0 | 152,660.5 |
| Rest, Food | 0.0 | 0.0 | 0.0 | 0.0 | 18,883.5 | 0.0 | 18,883.5 |
| Room "El Vigía" | 1,232.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,232.9 |
| Safe | 0.0 | 0.0 | 0.0 | 46,170.3 | 0.0 | 0.0 | 46,170.3 |
| Salon bar drinks | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.5 | 7.5 |
| Snack bar drinks | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 338,553.6 | 338,553.6 |
| Snack bar food | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 54,468.9 | 54,468.9 |
| See-sight supplement | 0.0 | 0.0 | 0.0 | 7,451.8 | 0.0 | 0.0 | 7,451.8 |
| Telephone | 0.0 | 0.0 | 0.0 | 7,137.8 | 0.0 | 0.0 | 7,137.8 |
| Tennis court | 0.0 | 0.0 | 0.0 | 35.7 | 0.0 | 0.0 | 35.7 |
| Tennis rentals | 5,283.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5,283.7 |
| **Total** | **48,587.8** | **3,521,443.4** | **28,864.4** | **128,132.2** | **2,201,722.9** | **393,124.9** | **6,321,875.6** |

Source: own elaboration

**Table 5 Cost structure of departments (in €)**

| | DEPARTMENTS | | | | | |
|---|---|---|---|---|---|---|
| ITEMS | RENTALS | ACCOMMODATION | MINIBARS | CHECK-IN & ADMIN | RESTAURANT | SNACK BAR |
| Advertising | 0.0 | 171,207.2 | 0.0 | 21,400.9 | 17,120.7 | 4,280.2 |
| Beverages | 235.2 | 0.0 | 7,821.1 | 13,218.6 | 111,875.4 | 77,669.9 |
| Cleaning | 0.0 | 0.0 | 0.0 | 40,852.3 | 33,679.9 | 887.5 |
| Communications | 0.0 | 21,229.6 | 0.0 | 2,653.7 | 2,123.0 | 530.7 |
| Community charges | 0.0 | 3,261.9 | 0.0 | 407.7 | 326.2 | 81.6 |
| Customer services | 0.0 | 0.0 | 42.1 | 30,229.0 | 0.0 | 586.0 |
| Cutlery | 0.0 | 0.0 | 0.0 | 2,383.2 | 71.9 | 0.0 |
| Dishes | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Food | 311.4 | 0.0 | 710.1 | 17,804.2 | 650,703.1 | 20,968.7 |
| Glassware | 0.0 | 0.0 | 109.2 | 257.5 | 0.0 | 1,290.6 |
| Hotel uniforms | 0.0 | 0.0 | 0.0 | 6,045.7 | 78.3 | 0.0 |
| Insurance | 0.0 | 16,881.0 | 0.0 | 2,110.1 | 1,688.1 | 422.0 |
| Kitchenware | 0.0 | 959.4 | 0.0 | 308.9 | 298.1 | 57.3 |
| Lingerie | 0.0 | 7,401.7 | 12.0 | 17,238.4 | 0.0 | 0.0 |
| Office supplies | 0.0 | 0.0 | 0.0 | 32,213.1 | 0.0 | 0.0 |
| Other services | 0.0 | 72,849.5 | 0.0 | 9,106.2 | 7,284.9 | 1,821.2 |
| Professional services | 0.0 | 16,368.6 | 0.0 | 2,046.1 | 1,636.9 | 409.2 |
| Repair and maintenance | 0.0 | 191,689.5 | 0.0 | 23,961.2 | 19,169.0 | 4,792.2 |
| Replacement | 0.0 | 0.0 | 0.0 | 67.4 | 5.0 | 0.0 |
| Subcontractors | 0.0 | 124,820.5 | 0.0 | 452.1 | 361.7 | 90.4 |
| Supplies | 0.0 | 269,225.7 | 0.0 | 33,653.2 | 26,922.6 | 6,730.6 |
| Temporary works | 0.0 | 1,050.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| Transport | 0.0 | 11,783.6 | 0.0 | 1,472.9 | 1,178.4 | 294.6 |
| Various materials | 0.0 | 0.0 | 13.6 | 5,447.7 | 16,202.4 | 25,552.3 |
| Compensation of Employees | 7,353.2 | 1,055,896.3 | 3,841.0 | 343,380.8 | 1163,960.6 | 161,965.9 |
| Gross Operating Surplus | 40,688.0 | 1,556,818.3 | 16,315.3 | -478,578.8 | 147,036.9 | 84,694.0 |
| **PRODUCTION** | **48,587.8** | **3,521,443.4** | **28,864.4** | **128,132.2** | **2201,722.9** | **393,124.9** |

Source: own elaboration

The different expenditures on compensation of employees' related concepts were distributed according to the information provided by the hotel on the time allocation of each employee in each department. The gross operating surplus was calculated as a residual, i.e. as the difference between the total production and total consumption of intermediates and labour payments. Due to the fact that the check-in department invoices very few services to the clients, and the

administration department none at all, the gross operating surplus of this combined department is negative. The surplus generated in the other areas of activity needs to compensate for this situation if the company wants to have a positive surplus. Once this information about the cost structure is available it is really simple to calculate the impact on the gross operating surplus of each section of the firm, of a change in the price of any of the inputs, depending on the part of this increase that the hotel administration is ready to pass over to their clients.

The second block of the destination table that we need to build is related to the final demand for the services provided by the hotel. Input-output tables normally aggregate consumption in one single vector. In our case, working with just one representative consumer would tremendously reduce the simulation possibilities at the business level.

Using the different data bases provided by the tourism firm, we were able to classify the clients attending to their origin and to the size of the group. These two client classification criteria, nationality and type of group, are shown in Table 6. Combining the two elements, we were able to generate 20 client categories. An extra category, named 'ND' –for not defined-, is used for those clients without the before mentioned information details. This kind of clients are frequent in certain periods like New Year's Eve, when clients make expenditures in the hotel without spending the night at the hotel.

**Table 6 Client classification criteria**

| Nationality | Definition |
|---|---|
| DE | Germany |
| ES | Spain |
| GB | Great Britain |
| OT | Other countries |
| **Groups** | **Definition** |
| 1 | 1 adult no kids |
| 2 | 1 adult with kids |
| 3 | 2 or more adults no kids |
| 4 | 2 or more adults with kids |
| 5 | Unaccompanied kids |

Source: own elaboration

Using these classification criteria, we can build the final consumption cell of Table 2. It has the 24 items considered in Table 4 and 21 columns, one for each group of clients. In Table 7 we present a summary of expenditure by nationality and group of clients. The first four columns reflect the same data as the rest of the columns but classified by nationality.

**Table 7 Final expenditure by categories of clients (in €)**

| ITEM | DE | ES | GB | OT | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 | ND |
|---|---|---|---|---|---|---|---|---|---|---|
| Accommodation | 1,966,174.5 | 230,139.4 | 295,450.2 | 241,453.8 | 388,209.3 | 26,772.8 | 2,139,093.7 | 159,208.8 | 19,933.4 | 788,225.4 |
| Atypical | 118.0 | 0.0 | 22.3 | 15.7 | 118.0 | 0.0 | 38.0 | 0.0 | 0.0 | 2,082.7 |
| Beauty | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 630.9 |
| Billiards | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 841.1 |
| Board | 1,070,709.4 | 99,016.1 | 174,544.0 | 114,866.9 | 163,307.9 | 13,410.1 | 1,192,020.9 | 78,718.2 | 11,679.2 | 449,005.9 |
| Cellar bar salon | 72.7 | 0.0 | 0.0 | 0.0 | 36.4 | 0.0 | 36.4 | 0.0 | 0.0 | 22.3 |
| Clothes spa | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 511.8 |
| DVD | 7.7 | 3.8 | 7.7 | 5.7 | 0.0 | 0.0 | 15.3 | 9.6 | 0.0 | 15.3 |
| Extra ticket | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14,834.6 |
| Fax | 29.9 | 7.2 | 1.2 | 1.2 | 17.3 | 0.0 | 21.0 | 1.2 | 0.0 | 34.0 |
| Forex | 0.0 | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 0.0 | 0.0 | 368.9 |
| Guards | 19.1 | 0.0 | 19.1 | 0.0 | 0.0 | 0.0 | 38.2 | 0.0 | 0.0 | 0.0 |
| Health & beauty | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 548.5 |
| Internet | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2,223.6 |
| Light | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 16.7 |
| Lingerie | 766.0 | 62.1 | 235.5 | 120.2 | 352.2 | 0.0 | 741.2 | 77.1 | 13.2 | 500.4 |
| Massage | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 789.7 |
| Massage à la carte | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,230.4 |
| Massage rentals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 42,071.3 |
| Minibar drinks | 12,934.7 | 2,995.5 | 3,291.8 | 2,288.2 | 4,346.9 | 454.8 | 14,953.7 | 1,437.1 | 317.7 | 5,795.7 |
| Minibar food | 603.3 | 245.6 | 261.1 | 100.6 | 340.3 | 34.8 | 711.6 | 94.8 | 29.0 | 348.1 |
| Parties | 11,925.8 | 2,585.1 | 11,624.5 | 4,665.4 | 5,838.6 | 844.9 | 22,020.1 | 1,775.0 | 322.2 | 10,463.1 |
| Rest, Beverages | 66,136.5 | 5,828.0 | 7,470.1 | 5,899.0 | 8,299.7 | 793.7 | 69,253.5 | 6,411.9 | 574.9 | 36,703.1 |
| Rest, Bodega | 77,598.5 | 6,447.5 | 15,974.6 | 10,019.8 | 10,382.9 | 832.2 | 91,722.3 | 6,307.9 | 795.0 | 42,620.1 |
| Rest, Food | 697.8 | 786.2 | 131.3 | 87.2 | 329.5 | 0.0 | 1,103.5 | 269.5 | 0.0 | 17,181.1 |
| Room "El Vigía" | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,232.9 |
| Safe | 26,151.7 | 527.6 | 3,981.3 | 2,061.2 | 5,575.6 | 200.7 | 25,758.3 | 1,124.1 | 63.1 | 13,448.6 |
| Salon bar drinks | 7.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.5 | 0.0 | 0.0 | 0.0 |
| Snack bar drinks | 139,385.2 | 14,257.7 | 36,558.4 | 12,080.5 | 21,885.7 | 2,089.8 | 162,240.8 | 14,304.2 | 1,761.2 | 136,271.9 |
| Snack bar food | 13,925.5 | 7,093.2 | 5,481.1 | 2,080.5 | 2,652.4 | 661.0 | 20,815.7 | 3,925.4 | 525.9 | 25,888.6 |
| Supplement see-sight | 3,661.6 | 51.0 | 305.9 | 63.7 | 539.2 | 0.0 | 3,460.1 | 38.2 | 44.6 | 3,369.6 |
| Telephone | 4,176.0 | 302.7 | 527.9 | 106.0 | 1,456.6 | 59.6 | 3,431.8 | 160.3 | 4.1 | 2,025.3 |
| Tennis court | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 35.7 |
| Tennis rentals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5,283.7 |
| **Total** | **3,395,101.1** | **370,350.6** | **555,887.9** | **395,915.5** | **613,688.5** | **46,154.4** | **3,747,485.4** | **273,863.2** | **36,063.7** | **1,604,620.5** |

The most important group by nationality is the group of German clients, which represents 54% of all expenditure. By type of clients, the third group (two or more adults without children) is the most significant one in terms of turnover (60%), and by type of expenditure, accommodation (56%) and board and restaurants (35%) represent most of the expenses.

Studying the evolution over time of final consumption by clients' categories could help confirm the impact of changes in the quality or the prices of the different products offered by the hotel. At the same time, following the relative importance of the different types of clients may clearly help in defining the marketing priorities of any hotel.

In order to complete the last stage of the preparation of the enterprise destination table, the balance of total uses and resources of goods and services in the company, we need to incorporate the flows related to the change in stocks and the fixed gross capital formation. This information is summarized in Table 8.

**Table 8: Change in stocks and fixed-gross-capital-formation (in €)**

| Item | Change in Stocks | Fixed Gross Capital Formation |
|---|---|---|
| Advertising | 0.0 | 0.0 |
| Beverages | 535.0 | 0.0 |
| Cleaning | -0.7 | 2,448.5 |
| Communications | 0.0 | 0.0 |
| Community charges | 0.0 | 0.0 |
| Customer services | 1,030.1 | 0.0 |
| Cutlery | 0.0 | 5,453.6 |
| Dishes | 0.0 | 11,420.9 |
| Food | 2,958.4 | 0.0 |
| Glassware | -69.2 | 7,394.4 |
| Hotel uniforms | 0.0 | 0.0 |
| Insurance | 0.0 | 0.0 |
| Kitchenware | -60.0 | 5,133.9 |
| Lingerie | 0.0 | 0.0 |
| Office supplies | 0.0 | 0.0 |
| Other services | 0.0 | 0.0 |
| Professional services | 0.0 | 0.0 |
| Repair and | 0.0 | 0.0 |
| Replacement | -9,862.8 | 11,506.1 |
| Subcontractors | 0.0 | 0.0 |
| Supplies | 0.0 | 0.0 |
| Temporary works | 0.0 | 0.0 |
| Transport | 0.0 | 0.0 |
| Various materials | -110.1 | 192.0 |

Source: own elaboration

The resources and uses of third-party goods and services are now balanced. As an example, if we take the beverages used as intermediate goods from Table 5 (210,820.2€), and the change in stocks observed in beverages in Table 8 (535.0€), both uses add up to the total availability of resources in beverages from Table 3 (211,355.2€). The resources and uses of own goods and services are also balanced. The sum of the value of production by department in Table 4, obtained by aggregating the value of the own goods and services produced, equals the total by department in Table 5, calculated as the total costs of production by department. On the other hand, the value of the total expenditure in own goods and services (see Table 7) also coincides with the total value of the goods and services produced. For the system to be in equilibrium, total demand and supply by product should coincide. That is, the row sums of the origin and destination tables by products should be the same.

Once the Hotel input-output framework is ready and balanced, we can start constructing economic models based on this accounting structure. A quite complete description of economic models that can be constructed with any input-output data framework can be found in Miller and Blair (2009) and Thijs teen Raa (2005). These models take advantage of the information on the cost and demand structure to develop price and demand models, among others. The next section develops an example of the possibilities of these demand models to analyse the impact on the hotel economic activity of changes in the demand of its clients.

## 5.- DEMAND ANALYSIS SIMULATIONS

### 5.1.- Demand Model with Commodity by Department Accounts

As we stated at the beginning of the paper, the main aim of this contribution consists in the preparation of an input-output data framework at the business level for the hospitality sector. However, in order to illustrate the potential applications of this effort, we designed some simple simulations in which we altered the duration of the stay of the clients, and calculated the impact of these changes in the gross operating surplus of the different departments of the hotel. The model used in the simulations is described in the following paragraphs.

The origin and destination tables we have described so far can be amalgamated in a single table where different classification criteria are used. Table 9 reproduces this new input-output table with commodity by department accounts. Matrices are expressed in capital letters and vectors with capital letters and underlined on the top. Scalars are indicated with capital letters but no

sub-index. The indices, always in lower case, indicate the number of rows and columns. We are only considering the warehouse as the origin of third-party goods and services. If we had information about the different suppliers (e.g. by sector or origin), we could use a new index to represent them. The department, own goods and services and third-party goods and services accounts should be balanced, which implies that the row and column sum for these accounts should coincide. These equalities will help us establish the main economic relationships for our demand model, using standard commodity-by-industry input-output techniques.

**Table 9 Commodity by department input-output accounts**

| | Departments (d) | Own goods and services (o) | Third-party goods and services (t) | Consumption by Clients (c) | Gross Capital F. (k) | Total |
|---|---|---|---|---|---|---|
| Departments (d) | | $DO_{d,o}$ | | | | $\bar{\bar{X}}_d$ |
| Warehouse | | | $\overline{W'_t}$ | | | W |
| Own goods and services (o) | $OD_{o,d}$ | | | $OC_{o,c}$ | $OK_{o,k}$ | $\bar{\bar{O}}_o$ |
| Third-party goods and services (t) | $TD_{t,d}$ | | | | $TK_{t,k}$ | $\bar{\bar{T}}'_t$ |
| Value Added (f) | $VA_{f,d}$ | | | | | $\overline{VA}'_f$ |
| Total | $\bar{\bar{X}}'_d$ | $\bar{\bar{O}}'_o$ | $\bar{\bar{T}}'_t$ | $\bar{\bar{E}}'_c$ | $\bar{\bar{K}}'_k$ | |

The matrices DO and W are the transposes of the 'Production of own goods and services by department' and 'Purchases' cells of the enterprise origin table, respectively (Table 1). Columns 1, 4 and 3 of Table 9 correspond to columns 1, 2 and 3 of the enterprise destination table (Table 2), respectively.

Table 10 registers some of the matrices of coefficients that we can generate with the available matrices. We indicate the transpose of a matrix or vector by " ' ". Vectors are considered to be column vectors unless otherwise stated. Vector $i_n$ is a column vector of ones of dimension n. $\hat{X}$ stands for a diagonal matrix built from vector X.

**Table 10: Commodity by department input-output accounts coefficients**

| | Departments (d) | Own goods and services (o) | Third-party goods and services (t) | Consumption by Clients (c) | Gross Capital F. (k) |
|---|---|---|---|---|---|
| Departments (d) | | $[DO \cdot \hat{O}^{-1}]$<br>$[DO' \cdot \hat{X}^{-1}]$ | | | |
| Warehouse | | | $[\overline{W}/W]$ | | |
| Own goods and services (o) | $[OD \cdot \hat{X}^{-1}]$ | | | $[\hat{O}^{-1} \cdot OC]$<br>$[OC \cdot \hat{E}^{-1}]$ | $[\hat{O}^{-1} \cdot OK]$<br>$[OK \cdot \hat{K}^{-1}]$ |
| Third-party goods and services (t) | $[TD \cdot \hat{X}^{-1}]$ | | | | $[\hat{T}^{-1} \cdot TK]$<br>$[TK \cdot \hat{K}^{-1}]$ |
| Value Added (f) | $[FD \cdot \hat{X}^{-1}]$ | | | | |

Starting with the definition of the vector of total own goods and services available that can be extracted from the third row of Tables 9 and 10:

$$\left[OD \cdot \hat{X}^{-1}\right] \cdot \bar{X} + \overline{OC} \cdot i_c + \overline{OK} \cdot i_k = \bar{O} \quad (1)$$

and defining the vector $\overline{D}$ of final demand as:

$$\overline{OC} \cdot i_c + \overline{OK} \cdot i_k = \overline{D} \quad (2)$$

we get

$$\left[OD \cdot \hat{X}^{-1}\right] \cdot \bar{X} + \overline{D} = \bar{O} \quad (3)$$

If we assume the industry-based technology assumption, which assumes that the production of each own goods and services, given by vector $\bar{O}$, is produced by the departments in fixed proportions, given by $\left[DO \cdot \hat{O}^{-1}\right]$, (3) becomes

$$\left[OD \cdot \hat{X}^{-1}\right] \cdot \left[DO \cdot \hat{O}^{-1}\right] \cdot \bar{O} + \overline{D} = \bar{O} \quad (4)$$

We can now obtain the new vector $\bar{O}$ of own goods and services that needs to be produced in order to satisfy any given vector of final demand $\overline{D}$, also expressed in own goods and services as

$$\bar{O} = \left[I - \left[OD \cdot \hat{X}^{-1}\right] \cdot \left[DO \cdot \hat{O}^{-1}\right]\right]^{-1} \cdot \overline{D} \quad (5)$$

If we want to calculate the vector $\bar{X}$ of production by departments that needs to be produced in order to satisfy the same vector of final demand $\bar{D}$, expressed in own goods and services and following the same industry-based technology assumption, we can proceed as follows:

Since

$$\left[OD \cdot \hat{X}^{-1}\right] \cdot \bar{X} + \bar{D} = \bar{O} \quad (6)$$

Pre-multiplying by $\left[DO \cdot \hat{O}^{-1}\right]$:

$$\left[DO \cdot \hat{O}^{-1}\right] \cdot \left[OD \cdot \hat{X}^{-1}\right] \cdot \bar{X} + \left[DO \cdot \hat{O}^{-1}\right] \cdot \bar{D} = \left[DO \cdot \hat{O}^{-1}\right] \cdot \bar{O} = \bar{X} \quad (7)$$

If we factor out $\bar{X}$:

$$\bar{X} = \left[I - \left[DO \cdot \hat{O}^{-1}\right] \cdot \left[OD \cdot \hat{X}^{-1}\right]\right]^{-1} \cdot \left[DO \cdot \hat{O}^{-1}\right] \cdot \bar{D} \quad (8)$$

If we now assume the commodity-based technology assumption, which assumes that the production of each department's total output, given by vector $\bar{X}$, is made up of own goods and services in fixed proportions, given by $\left[DO' \cdot \hat{X}^{-1}\right]$, we can express (3) as follows:

$$\left[OD \cdot \hat{X}^{-1}\right] \cdot \bar{X} + \bar{D} = \left[DO' \cdot \hat{X}^{-1}\right] \cdot \bar{X} \quad (9)$$

Pre-multiplying by $\left[DO' \cdot \hat{X}^{-1}\right]'$ we get:

$$\left[DO' \cdot \hat{X}^{-1}\right]' \cdot \left[OD \cdot \hat{X}^{-1}\right] \cdot \bar{X} + \left[DO' \cdot \hat{X}^{-1}\right]' \cdot \bar{D} = \left[DO' \cdot \hat{X}^{-1}\right]' \cdot \left[DO' \cdot \hat{X}^{-1}\right] \cdot \bar{X} \quad (10)$$

We can now factor out $\bar{X}$:

$$\bar{X} = \left[\left[DO' \cdot \hat{X}^{-1}\right]' \cdot \left[DO' \cdot \hat{X}^{-1}\right] - \left[DO' \cdot \hat{X}^{-1}\right]' \cdot \left[OD \cdot \hat{X}^{-1}\right]\right]^{-1} \cdot \left[DO' \cdot \hat{X}^{-1}\right]' \cdot \bar{D} \quad (11)$$

If we want to calculate the vector $\bar{O}$ of own goods and services that needs to be produced in order to satisfy the same vector of final demand following the same commodity-based technology assumption, we just need to pre-multiply vector $\bar{X}$ obtained in (11) by $\left[DO' \cdot \hat{X}^{-1}\right]$.

**5.2.- Impact of Changes in Demand at the Hospitality Enterprise Level**

With the information contained in Table 9 and the commodity-by-industry input-output models defined above, we could easily describe the impact of absolute or relative changes in the vectors of demand by clients. However, wishing to define more elaborated demand changes, we have worked out the consumption by clients to be expressed as consumption by person and day.

Using the information provided by the firm about the size of each group of clients and the duration of their stay by reservation, a new measurement unit named 'people-days' was introduced. The quantity of people-days was calculated for each group of clients and their values are included in Table 11.

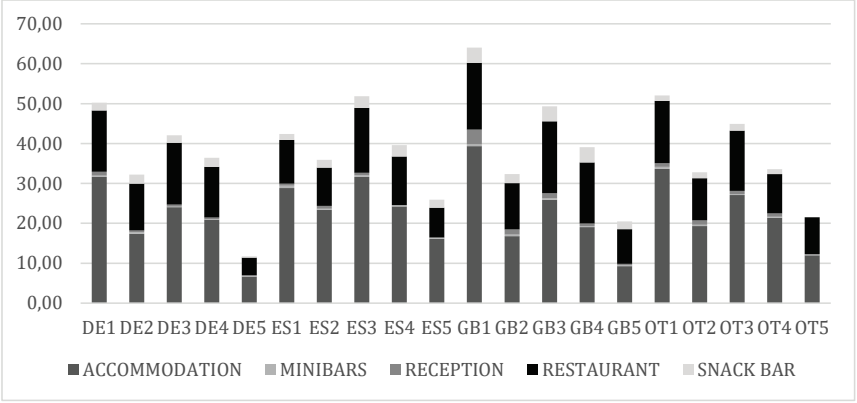
**Table 11: People-days by types of clients**

| | | Nationality | | | |
|---|---|---|---|---|---|
| | | DE | ES | GB | OT |
| Groups | 1 | 9,293 | 1,158 | 955 | 700 |
| | 2 | 458 | 364 | 201 | 360 |
| | 3 | 66,026 | 4,113 | 8,983 | 6,991 |
| | 4 | 3,397 | 2,096 | 893 | 962 |
| | 5 | 1,043 | 463 | 506 | 68 |

Source: own elaboration

The German clients achieve the highest value by nationality, with 80,217 people-days (column sum). Far below is the second nationality in importance, the British, with 11,538 people-days. The third group of clients (two or more adults without children or babies) is clearly the most numerous, with 86,113 people-days. It is easy now to compute what is the average value of goods and services demanded by people-day and type and nationality of the client, as presented in Figure 1.

**Figure 1: Sales (in €) by person and day, by department and by type of client**




Source: own elaboration

The relative structure of each of the groups within each of the nationalities follows a similar pattern among the different nationalities. But within each nationality, the value of the different types of spending varies significantly between the departments. The highest daily revenues coming from accommodation by person and day correspond to the British in group 1 (39.35 euros per day). The second most important group, 'restaurant' has its highest value (18 euros per day) for the British clients associated to group 3. The highest expenditure in 'snack bar' corresponds again to the British clients belonging to group 1 (3.81 € per day).

We have defined changes in the demand of the clients using our information about stays by type of client. We increased the length of stay of each type of client by one day in accordance with the type of client and the nationality. Table 12 shows the eight simulations formulated.

**Table 12: Nationality or group that increases their stay in one day**

| | |
|---|---|
| Simulation 1 | German (DE) |
| Simulation 2 | Spanish (ES) |
| Simulation 3 | British (GB) |
| Simulation 4 | Group 1 |
| Simulation 5 | Group 2 |
| Simulation 6 | Group 3 |
| Simulation 7 | Group 4 |
| Simulation 8 | Group 5 |

Source: own elaboration

The new total number of people-days by group of clients was calculated for each simulation. Applying the average expenditure of the different clients in each of the own goods and services provided by the hotel, we calculated the new vectors of final demand associated with each simulation. Using the industry-based technology assumption and the formulation of equation (5), we can calculate the production – sales – by department needed to satisfy these new demands. Matrices $[OD \cdot \hat{X}^{-1}]$, $[TD \cdot \hat{X}^{-1}]$ and $[FD \cdot \hat{X}^{-1}]$ from Table 10 allow us to calculate the new levels of intermediate consumption and gross operating surplus of the hotel generated by each new level of sales.

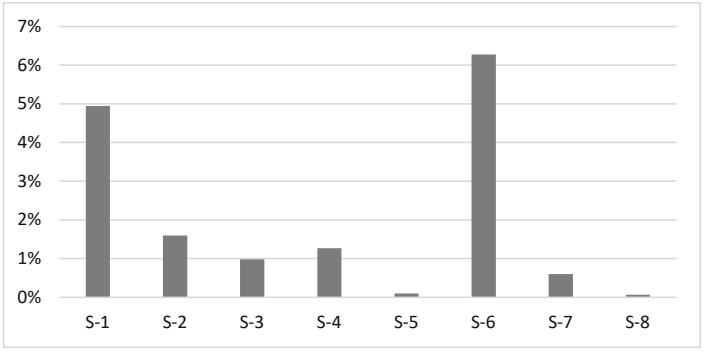
If we observe the results of the first three simulations in Figure 2, the most important effect on the firm's gross operating surplus corresponds to simulation 1 (increase in the stays of clients with German origin), causing a 5% increase in gross operating surplus. As indicated before, clients coming from Spain and Great Britain provide the highest daily profit, however German clients, being the most frequent visitors, bring the highest surplus to the company. If, instead of

considering the nationality, we turn to the analysis by groups of clients offered by the rest of the simulations, group 3 emerges as having the most important effect due again to the fact that it comprises the most numerous types of clients of this hotel.

The changes in gross operating surplus differ according to the simulation due to the fact that the composition of the sales for each type of client in terms of the relative importance of gross operating surplus over production is not the same. This type of information can be very useful for those responsible for marketing the hotel.

Naturally this is just an example of the impact analysis that can be carried out with this accounting framework and model. Essentially, we can apply most aspects of input-output theory and models to this framework, which offers an enormous amount of simulation possibilities. The increasingly pressing need for hotels to certify their environmental impact could offer especial relevance to the availability of these detailed enterprise input-output tables and models.

**Figure 2: Change in gross operating surplus in each of the simulations (in %)**




Source: own elaboration

## 6.- CONCLUSIONS

Enterprise input-output offers great potential for the economic representation of the main activities of a hotel. When compared in different time periods enterprise input-output tables can serve to identify structural changes in the functioning of the hotel. They can also be used to compare the structural differences existing in different hotels. The most relevant contribution in this sense comes from the fact that the links between demand and production are perfectly

represented in the same framework. This combination, together with the main accounting relationships that can be established, opens up the possibility of developing economic models that allow the economic impact of changes in demand and prices to be calculated.

The two main drawbacks of the input-output methodology also apply to enterprise input-output. Constant coefficients represent the technology of the hotel. On the other hand, these models assume the unrestricted availability of resources. The first disadvantage can be overcome if this enterprise input-output table is incorporated as a new sector into a calibrated general equilibrium model, where the functional forms are calibrated with the information contained in the enterprise input-output table. In such a model, the production of the different departments can assume different functional forms that allow for inputs and factor substitution. Another possibility consists in preparing partial equilibrium models where the calibrated production functions do not present constant returns to scale. In this case, an increase in production due to a change in demand does not imply a proportional increase in the input and factor demands.

The problem of the availability of resources can pose relevant problems both at the economy-wide and at the company level, since more inputs and factors of production may not be available, especially in the short term. When we increase demand, we are assuming there is no problem in the availability of inputs and factors. Economy-wide models deal with this problem using non-linear input-output models as considered in Klijs, Peerlings, and Heijman (2017). They introduce factor augmenting technical change in order to incorporate labour productivity changes. A similar approach could be used in the case of impact analysis using enterprise input-output models.

We have to bear in mind that enterprise input-output is not restricted to analysis at the business level. Enterprise input-output tables of hotels can be introduced into CGE models, in the same way as we introduce detailed consumer behaviour when combining general equilibrium with microsimulation techniques. Actually, using this detailed information could also allow independent microsimulation models at the supply level, making up for a lack of experience in this area. We would not need to directly estimate the enterprise input-output table of every single hospitality business. Having detailed enterprise input-output tables of the different types of hospitality establishments (apartments, hotels of different star qualifications, etc.) should be sufficient. Input-output tables updating and adjustment techniques could be used to extend these canonical enterprise input-output tables to the total population of hospitality businesses. The structure would be essentially the same for each type of business, but each adjusted enterprise

input-output table would respect the main economic aggregates that can be easily obtained from open-source accounting financial statements.

The use of enterprise input-output tables and models can become an important complement to other tools in decision-making because of its ease of use and its capacity to analyse demand and price shocks under different formulations (revenue management, LCA, multiplier analysis, optimization models etc.). We have to bear in mind that all the variations described in the literature review of this paper, mainly analysis at the structural, production processes or environmental levels can be also applied in this setting. In all these areas the availability of enterprise input-output tables for the hospitality sector could definitely mean promising new lines of research.

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