# Towards "a sky full of Michelin Stars"

Jose I. Castillo-Manzano [a,*], Álvaro Zarzoso [b]

[a] Applied Economics & Management Research Group, Universidad de Sevilla, Spain
[b] Universidad de Sevilla, Spain

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## ABSTRACT

Michelin-starred restaurants are not only the greatest exponent of haute cuisine in hospitality industry but also key players in the process of the development of gastronomy, food science, tourism destinations, and even regional economies. Despite the impact of this award, the previous academic literature has not addressed the factors and determinants that enable destinations to accrue Michelin-starred restaurants. This paper intends to be the first study that covers this gap using a rigorous econometric analysis (panel data) focused on the case of the Spanish provinces (NUTS-3). Results suggest that the promotion of international tourism (rather than domestic tourism), high-quality supply (such as PDOs), R&D institutions, luxury sectors and hospitality internship among others, might foster the development of appropriate ecosystems for Michelin-starred restaurants in the hospitality industry. The conclusions seek to serve as a basis not only for the development of managerial implications for the hospitality and tourism managers, including a public policy perspective, given their significant and positive socio-economic externalities.

## 1. Introduction

### 1.1. Gastronomy and Michelin Stars

Gastronomy is a ubiquitous aspect of human life that is increasingly turning into a key factor for tourism and the hospitality industry (Martin et al., 2021) and an economic, social, and environmental aspect of the regions (Mulcahy, 2015). According to Chau and Yan (2021) gastronomy is indeed an indicator of destination hospitality and destination managers and tourism authorities should consider it as a such to benefit destination marketing and enhance tourist experience. In fact, some destinations have been already seeking to promote themselves through culinary elements, as the case of Italy, that has pushed UNESCO to declare the "Art of Neapolitan pizza makers" as Intangible Cultural Heritage of Humanity. However, measuring the quality of the gastronomy of different places and regions is not an easy task. One of the most common ways to do this is to use signaling instruments such as the Michelin Guide (Daries et al., 2018).

The Michelin Guide (or "Red Guide"), originally created in France in 1900 to encourage motorists to take to the road, presents, describes and classifies restaurants based on their quality (see Johnson et al., 2005 and Darries et al., 2021). Today, it enjoys an illustrious reputation worldwide as a source of information on restaurants —especially high-quality establishments— hotels, monuments, and museums (Kiatkawsin and Han, 2019).

Synergies may well exist between all these three elements of the hospitality and tourism industry. Firstly, fine dining restaurants have become a frequent facility for luxury hotels (e.g., 5-star hotel chains such as Four Seasons and Kempinski) to differentiate themselves in the accommodation sector (Prayag and de Cellery d'Allens, 2019). This could explain why Michelin-starred restaurants are sometimes located in luxury hotels and resorts. A good illustration of this is the fact that the SLH (Small Luxury Hotels of the World) network website includes "Hotels with Michelin Star restaurants" as a category to filter searches (SLH, 2021).

Secondly, some authors suggest that restaurants in top museums are as important as other museological spaces (Mihalache, 2016) and crucial assets for enhancing visitors' museum experiences (Wang and Chen, 2019). Thus, some Michelin-starred restaurants can be found inside museums. One example is the restaurant in the *Nerua Guggenheim Bilbao* restaurant (Levent and Mihalache, 2016), which was ranked 32nd in the prestigious TheWorlds50Best ranking in 2019 (TheWorlds50Best, 2019).

A priori, these potential synergies would allow destination managers to develop more sophisticated and effective destination marketing strategies, where the Michelin starred restaurants and its chefs play a

key role.

The Michelin Guide recognizes restaurants with a range of different awards: "Michelin Plate", "Bib Gourmand", and "Michelin Stars". The best known internationally are the "Michelin Stars" – categorized as one, two, or three stars - that distinguish the best restaurants and chefs on the international stage. Each distinction still maintains the original meaning of the guide – a road guide; one star means that it is worth stopping; two stars, that it is worth a detour, and three, that the trip would be justified by the restaurant alone (Michelin, 2020). That is, according to this definition, a 3-stars Michelin restaurant by itself could build a tourist destination, or, eventually, foster the attractiveness of the existing ones (see Daries et al., 2021 about the also higher profitability of a 3-stars Michelin restaurant). Table 1 gives a brief description of the different Michelin awards.

Michelin Stars are considered the most prestigious award that a restaurant can receive and the most authoritative indicator in the global hospitality-gastronomy industry (Chiang and Guo, 2021). Today, Michelin-starred restaurants are a symbol of high-level dining experiences and are internationally recognized (Kiatkawsin and Han, 2019). In fact, since 2021, the world-renowned website Tripadvisor —see Molinillo et al. (2016) and for the relevance of Tripadvisor for tourism and hospitality management— includes the Michelin Guide distinctions (Stars, Bib Gourmand, and Michelin Plate) among the information for every restaurant in every tourism destination. This again demonstrates the preeminence of Michelin awards over any other national or international award in the hospitality industry. This again demonstrates the preeminence of Michelin awards over any other national or international award in the hospitality industry and its relevance as a source of information for tourists.

These restaurants and their chefs attract the attention of the media and receive large flows of customers (Giousmpasoglou et al., 2020). Every year, when the new edition of the Michelin Guide is released, it is widely covered by the local, national, and sometimes, in the case of restaurants with three Michelin Stars, even the international media. In many countries, the presentation of the guide is a grandiose event that takes place in conference centers, historic theaters, or other emblematic buildings (Poullennec, 2011), in a ceremony that is akin to that of any great film or television awards show. Hence, the main Spanish tourist destinations compete every year to host this ceremony.

Furthermore, this media impact has turned numerous Michelin-star chefs into public figures, as many are the main attraction of major TV shows (Zopiatis and Melanthiou, 2019), where they play multiple roles, from cookery teachers to judges on reality cookery productions (Baltagi, 2008). In line with the above, the popularity of TV shows such as Masterchef is remarkable; currently owned by the BBC, it has been broadcast in its different formats (including Masterchef Celebrities and Masterchef Kids) in over 60 countries since 1990 (Andrieu and Batat, 2019).

Michelin Star chefs are also recognized as social innovators or even scientists, due to the complicated culinary techniques that they seek to develop (Mouritsen et al., 2018). Therefore, it is usual to see them playing the role of social leaders outside the field of gastronomy (Abend, 2010). One example of this could be the Michelin-Star chef José Andrés, who is in the prestigious TIME 100 ranking of the most influential people in the world, and who has received multiple awards such as the United States National Endowment for Humanities and the Princess of Asturias Award (Muñoz, 2021).

As indicated in Albuquerque et al. (2019), from an economic and social perspective, a Michelin-starred restaurant triggers a series of synergies capable of giving a boost to regional gastronomies and economies. This award could even be said to generate a nationalistic feeling in the areas where such restaurants are found, especially when they have 2 or 3 Michelin Stars, since it is perceived as a proxy not only for the quality of the local hospitality industry but also for the local food and culinary traditions (Messeni Petruzzelli. and Savino, 2015). Also, Michelin-starred restaurants have been considered a driver of the

agribusiness sector and tourism (Castillo-Manzano et al., 2021a). Lastly, in recent times has come to the light the concept of "foodification", as the process by which destinations transform their historic centers into a food-dominant retail space, to the point that gastronomy overcome other destination's key elements or even the destination itself (Loda et al., 2020). That shows the power of the gastronomy and how destination marketers and managers should consider it when formulating their policies, plans and actions.

The facts commented above, supported both by academic literature and the main actors of the gastronomy industry, justify the expansion of the Michelin Guide, and thus, the Michelin Stars, over 30 territories and destinations across three continents. Obviously, today is not anymore just a roads guide, but a tool to highlight the gastronomy of the tourist destinations.

Due to the relevance and wide impact of Michelin-starred restaurants on gastronomy, the tourism and hospitality industry, and even economic development, the academic literature has focused on researching this award from many perspectives. However, to date, no studies exist that address the factors and determinants that enable regions and destinations to accrue Michelin-starred restaurants, which eventually helps the economy to develop. Therefore, this study seeks to be the first to cover this gap. For this, it focuses on the case of the Spanish provinces (NUTS-3 disaggregation) and conducts a rigorous econometric analysis.

Specifically, we will test, using a robust and comprehensive set of hypotheses, different factors and determinants that could have a positive influence on the emergence of Michelin-starred restaurants. The selection of these factors is based on previous literature, both on restaurants in general and on Michelin-starred restaurants in particular, and on the criteria that the Michelin Guide itself uses to award Stars. Among these factors, the followings stand out: the influence of tourism, both national and foreign; the economic and research dynamism of the restaurant's location; the size of the hospitality sector; possible synergies with luxury hotels; the role of culinary schools in their immediate hinterland or Protected Designations of Origin (PDOs), among others. In short, this study is highly enriched by the novelty of the tested variables and hypotheses.

The conclusions seek to serve as a basis not only for the development of managerial implications for the tourism and hospitality industry but also from a public policy perspective, given their significant and positive socio-economic externalities.

Considering all the above, this paper is structured as follows: after this Introduction, Section 2 presents a detailed explanation of the study case, Spain; Section 3 states the hypotheses to be tested; Section 4 describes the empirical context of the research from the database to the econometric methodology; Section 5 presents the results and a discussion, and Section 6 offers a set of concluding remarks. Lastly, a list of references is provided.

*1.2. The case of Spain*

The case of Spain is especially interesting and relevant for a variety of reasons. First, due to the quality of Spanish gastronomy, which has been officially recognized by UNESCO with the designation of the Mediterranean Diet as an intangible World Heritage asset (UNESCO, 2013). Second, by a perception of high quality, as stated by international tourists in official surveys of tourist satisfaction (ICEX, 2019), which has contributed to Spain being the third most visited country in the world, only behind France and the United States (UNWTO, 2020) before the COVID-19 pandemic. And third, by the fact that Spain is in fifth place (as of 2019) in the ranking of countries with high numbers of Michelin-starred restaurants (Michelin, 2019) and the country with the highest number of restaurants, 6, listed in the 2022 TheWorlds50Best ranking (TheWorlds50Best, 2022).

Second, Spain has undergone a process of "michelanization" of its hospitality industry in the last 20 years. In other words, an increasing number of Spanish provinces have managed to accrue more Michelin-

starred restaurants (see Daries et al., 2021). Specifically, the number of restaurants with Michelin Stars in Spain has risen from 92 in 2000 to 207 in 2019, which represents a growth of 125%. From a different perspective, 43 of the 52 provinces (NUTS-3 regions) have at least one restaurant with a Michelin Star, while in 2000 only 23 provinces had any restaurants of this type at all. Fig. 1 illustrates this process.

Lastly, the explained geographic expansion has been compatible with a geographic concentration of the stars being awarded in the NUTS-2 regions of Madrid, Catalonia, and the Basque Country. Fig. 2 shows this evolution with a comparison of the number of restaurants with Michelin Stars in the Spanish provinces in 2000 and 2019. This might be a sign of agglomeration economies and the experience curve effect of these restaurants.

This variety of behaviors justifies our subsequent and more detailed econometric analysis of the main factors that explain the proliferation of these awards.

## 2. Materials and methods

### 2.1. Hypothesis development

In line with the previous description of the relevance of Michelin Stars, we have drawn some hypotheses to be tested with econometric models.

### 2.1.1. Hypothesis 1 (H1)

The recent academic literature (e.g., Castillo-Manzano et al., 2021a) upholds the idea that Michelin-starred restaurants might foster tourism demand at a given destination. In our case, we aim to assess whether a bidirectional effect exists, i.e., to test for any endogeneity between tourism and Michelin Stars as a virtuous circle of tourism destinations excellence, in the sense that Michelin Stars attract tourists and the tourists themselves increase the potential clientele of these top restaurants, which would give a boost to Michelin-starred restaurants. Given the different international and domestic tourism consumption patterns (Gil-Alana et al., 2021), we will test the influence of both variables: number of foreign tourists (H1.1) and number of domestic tourists (H2.2) by province. As is explained below, a special methodological approach is required to treat and test endogeneity.

### 2.1.2. Hypothesis 2 (H2)

We also test the extent to which Michelin Stars are related to local economic indicators since Michelin-starred restaurants are regarded as exclusive luxury experiences (Liu et al., 2022). The higher a region's income (per capita GDP), the more Michelin-starred restaurants it has? Is the income elasticity of Michelin services high, as it is for other luxury goods? (H2.1).

Are there any synergies with other luxury services in the hospitality sector of a destination? A priori, these synergies could be clearer with five-star hotels as they would be the most appropriate type of accommodation for patrons of haute cuisine restaurants. For example, in a recent research, Michael and Fusté-Forné (2022) have proven that luxury hotels aim to manage their image of luxury by promoting gastronomy through identifying visual features of social media posts. In addition, as stated in the introduction, the restaurants of these hotels themselves may end up obtaining their own Michelin Star(s) (H2.2).

In addition, we will test for any synergies between Michelin-starred restaurants and the main economic sectors, as Lee and Ha (2012) do for the restaurant industry. Specifically, we will analyze the relationship between these restaurants and the primary sector (agriculture + livestock + fisheries), the industry sector, and construction (H2.3). A priori, it is plausible to think that the greater the importance of these sectors for the economy, the greater the demand that could be generated for the services of these restaurants.

### 2.1.3. Hypothesis 3 (H3), 4 (H4), and 5 (H5)

Further hypotheses come directly from an analysis of the criteria for awarding the stars (see https://guide.michelin.com/sg/en/the-inspection-process-sg to check the publicly acknowledged assessment criteria). Anonymous Michelin Guide inspectors, professionals with over 5 years of experience in the sector who have received training from the Guide, evaluate these criteria annually. There are 85 inspectors in total, with 12 operating in Spain. This anonymous evaluation is a guarantee of quality in itself. There are five criteria:

- **First Michelin Guide criterion: "Ingredient choice and quality" (C1).**

In this case, we consider that a chef's score for this criterion might be influenced by the quality of food produce in the region (H3). In other words, there should be a positive synergy between the ingredients and restaurant excellence. In this sense, the higher the recognized quality of the produce in a province (Nuts 3 region), the easier it will be for the restaurant chef to prepare high-quality proximity cuisine.

As a proxy for the level of quality and variety of the food, we build a variable based on the number of Protected Designations of Origin (PDOs) by province (NUTS-3). PDOs are a seal of food authenticity used to protect high-quality products (Danezis et al., 2016) and require scientific techniques and bureaucratic processes (Camin et al., 2017). Such a complex system would justify the PDO on its own being a good proxy for food excellence.
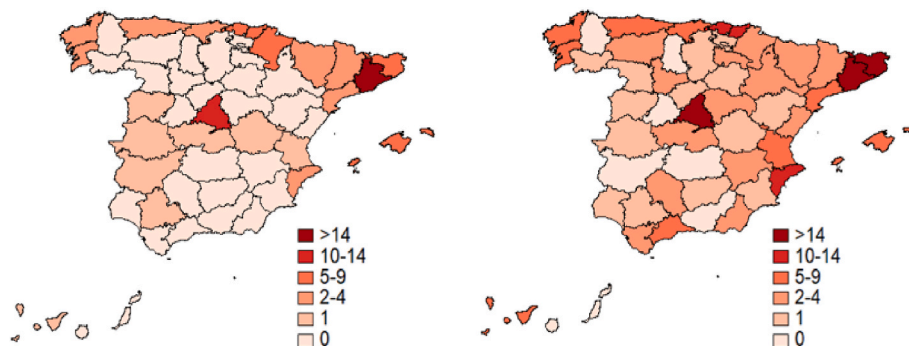


Source: Authors from Michelin Guide data (2019).

**Fig. 1.** Distribution of Michelin-starred Restaurants in Spain, by province. 2000 (left) −2019(right).
Source: Authors from Michelin Guide data (2019).
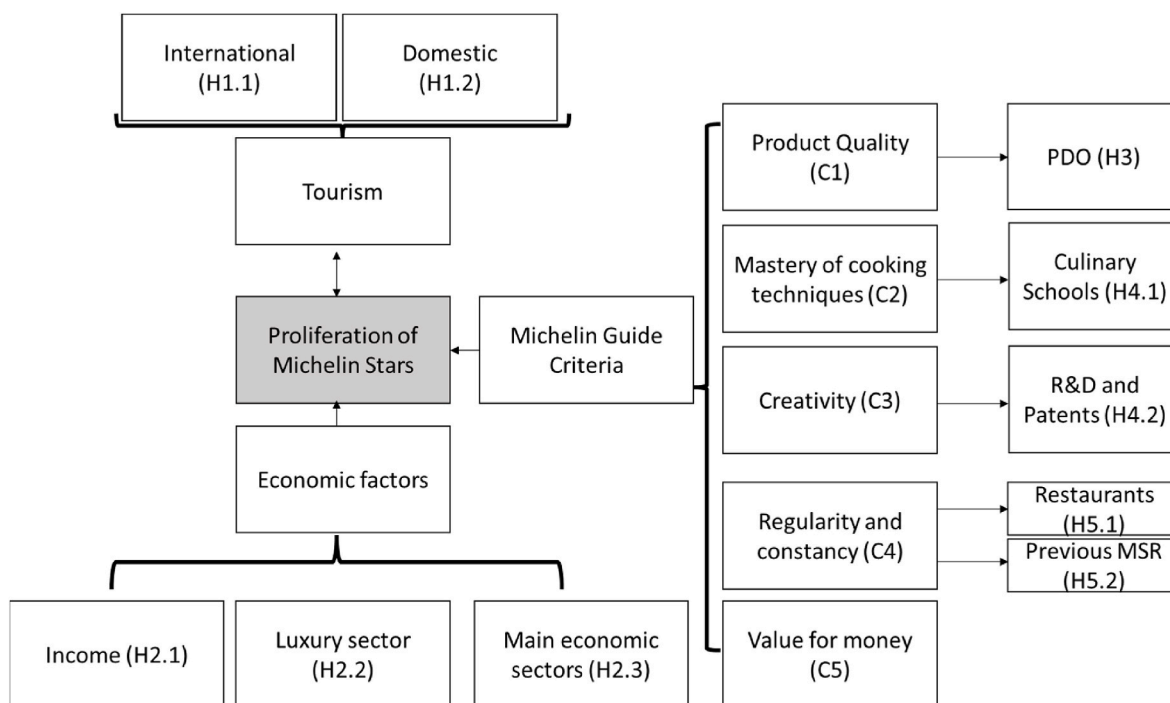
Source: Authors

**Fig. 2.** Hypothesis development.
Source: Authors

- **Second and third Michelin Guide criteria: "Mastery of cooking techniques and combining flavors" (C2) and "the creativity and personality of the cook embodied in the dish" (C3)**

According to these criteria and as argued by Vargas-Sánchez and López-Guzmán (2018), education, creativity, and innovation are key factors for Michelin-starred restaurants. So, specific training in gastronomy at top international culinary schools could lead to an increase in the number of Michelin-starred restaurants (H4.1).

Regarding creativity and innovation, Michelin-starred restaurants could be considered the R&D facilities of the hospitality industry (Ottenbacher and Harrington, 2007). In this sense, the hypothesis that we will test is that, where there is an environment with higher levels of R&D and creativity, there are also more competition and better skills (Lee et al., 2019) and, consequently, a greater chance of obtaining higher scores in C2 and C3 and accruing more Michelin Star awards (H4.2).

In this case, we use three different variables: number of top international culinary schools by province; R&D institutions by province, and number of university patents by province, which are strongly linked with an R&D and creativity environment (Koch and Simmler, 2020).

- **Fourth Michelin Guide criterion: "Regularity and consistency" (C4).**

Although C4 are skills closely related to the personal abilities of the restaurant's team managers (Lee et al., 2017), it is plausible that they are obtained more easily in an environment with a consolidated F&B sector (H5.1). We take the total number of restaurants per capita as the variable to measure the importance of this sector in the local economy. However, as is shown in Castillo-Manzano et al. (2021a), quantity does not always lead to quality. Therefore, a more accurate variable for regularity and consistency would be the number of Michelin-starred restaurants during the previous year (H5.2). In any case, the implementation of both of these variables gives an insight into the quantity

and quality of the sector.

- **Fifth Michelin Guide criterion: "value for money" (C5).**

The criterion of "value for money" (C5) is understood as the restaurant's ability to create memorable experience regardless of the price. In fact, according to Kiatkawsin and Han (2019), customers are willing to pay more in change of these haute experiences.

Due to the large range of prices found among Michelin-starred restaurants (from 365€ of Diverxo's tasting menu price drinks excluded https://diverxo.com/en/reservations/to 25€ of Silabario's tasting menu price https://silabario.gal/es/menus/berbes), we have opted to not include this criterion in our hypothesis set. The prices of the menus depend on many factors, such as location, labor costs and the own restaurants strategy, inter alia (Ozdemir and Caliskan, 2014).

The following figure summarizes the set of hypotheses that we aim to analyze using econometric models.

### 2.2. Data and methodology

A panel has been constructed with data for the Spanish provinces during the 2000–2019 period using a model that follows expression (1), where $i$ is provinces and $t$ is years:

$$Y_{it} = \alpha + \beta_k X_{it} + \gamma_k W_{it} + \delta_k Z_{it} + \varphi_k Year + \varepsilon_{it} \tag{1}$$

The Spanish provinces are defined as NUTS-3 regions under the Eurtostat classification for territorial units. Among these regions, we find some of the most important tourist destinations in the world, both in sun-and-sand (Islas Baleares, Tenerife, Las Palmas or Malaga) and cultural and business tourism (Madrid, Barcelona, Seville or Granada).

The dependent variable ($Y_{it}$) is the number of Michelin-starred (1, 2, or 3) restaurants by province. As is established by the histogram in Fig. 3, this is a count variable characterized by non-negative integers. Conventional methods such as the OLS technique may therefore be inappropriate (Rufrancos et al., 2013) as the assumption of residual
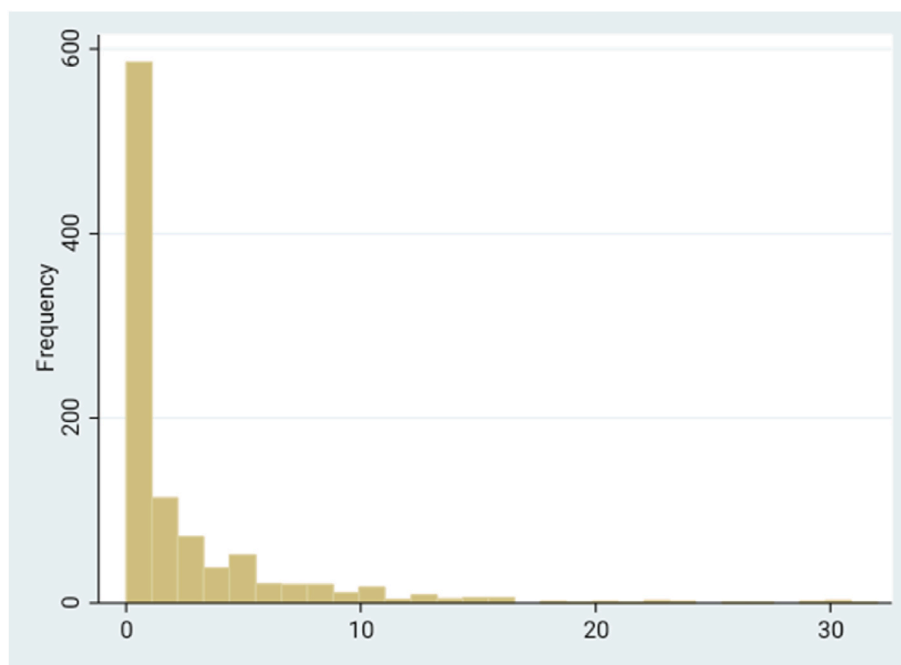
Source: Authors

**Fig. 3.** Distribution of Michelin-starred restaurants variable.
Source: Authors

normality is not guaranteed (see normality test results in Table 3), so a Poisson specification has to be used (Silva and Tenreyro, 2011).

The independent variables are organized in line with the hypothesis development. $X_{it}$ are the tourism-related variables. Specifically, we include the number of foreign tourists and the number of domestic tourists by province (both logarithms). Both have been typically applied in tourism demand models such as in Khoshnevis and Khanalizadeh (2016) and Castillo-Manzano et al. (2020, 2021b) for the case of Spain. These two variables are not included in the same model but rather in two independent models, due to the existence of high correlation. This would allow to control for the different impacts that foreign and domestic tourism might have on the Michelin-starred restaurants since they tend to follow different patterns (Gil-Alana et al., 2021).

It is plausible to think that there are endogeneity issues between the dependent variable and the tourism demand variables, given that the opposite relationship has already been proposed by Castillo-Manzano et al. (2021a), which explained that Michelin-starred restaurants are a proxy and catalyzer of gastronomy excellence, which could be a determinant of tourism demand. If that is the case, endogeneity would cause inconsistency and bias in the coefficients and so must be properly addressed (Baltagi, 2008).

To deal with this challenge —endogeneity issues in panel data Poisson regression— the two-phase procedure proposed by Lin and Wooldridge (2019) is applied.

The first step estimates the reduced form equation for the endogenous variable (Michelin-starred restaurants) using the fixed effects (FE) approach and obtains FE residuals. In the reduced form equation, valid instruments are required that should typically be correlated with tourism demand but uncorrelated with Michelin Stars. So, we have applied three instruments that have been proven to be important determinants of tourism demand, both generally and in the Spanish market in particular, in the broad academic literature (Alvarez-Diaz et al., 2020; Albaladejo et al., 2016):

- Consumer price index; a variable that is a "must" in any (tourism) demand model (Jiao and Chen, 2019).
- Number of cultural World Heritage Sites (WHS) designated by UNESCO, by province, as in Cuccia et al. (2016) or in Castillo-Manzano et al. (2021c).
- Average maximum temperature by province, as in Bujosa and Rosselló (2013).

The second step estimates the Poisson equation. The fixed effect approach (FE) is used once more, with the FE residuals obtained in the first step included as a control function.

$W_{it}$ represents a set of variables related to economic factors (H2): first, GDP per capita, as a typical indicator of income; second, the number of 5-star restaurants per foreign tourists, as a proxy of the level of luxury in the province, and third, the weights of the agriculture sector, industry, and construction in the GDP.

Finally, $Z_{it}$ represents the group of variables that are related to the Michelin Guide criteria:

- Number of PDO per km2 by province, as a proxy of quality produce.
- Number of top culinary schools per capita by province, linked to the mastery of cooking criteria.
- Number of R&D institutions per capita by province and the number of university patents by province (both logarithms), as indicators of the creativity, research, and innovation ability of each province.
- Total number of restaurants per capita (logarithm), as a quantitative proxy of the catering sector's involvement in each province. A lagged dependent variable (number of Michelin-starred restaurants by province in t-1) as it is plausible to think that is easier to retain the award than to win it for the first time.

The definition and descriptive statistics of the variables are given in Table 2.

**Table 1**

Michelin guide awards.

| AWARD | DESCRIPTION | ORIGIN |
|---|---|---|
| **1 Michelin Star** | High-quality cooking. Worth a stop! | 1926 |
| **2 Michelin Stars** | Excellent cooking. Worth a detour! | 1931 |
| **3 Michelin Stars** | Exceptional cuisine. Worth a special trip! | 1931 |
| **Bib Gourmand** | Quality cuisine at a reasonable price (starter, main, and dessert for around €35) | 1997 |
| **Michelin Plate** | Quality cuisine. Guaranteed quality but without reaching the level of Bib Gourmand or a Michelin Star | 2017 |

Source: Michelin (2020).

## 3. Results

Following the data and methodology explained above, we estimate two different regressions. The first variant is a classical FE Poisson regression mean specification which accounts for heterogeneity endogeneity and ignores idiosyncratic endogeneity. The second specification (LW) is essentially the two-phase procedure proposed by Lin and Wooldridge (2019) and described in previous section, which accommodates idiosyncratic endogeneity. We estimate two models for each of these regression variants: one for foreign tourists (I & III) and the other for domestic tourists (II & IV). As shown in Table 3, there are four regressions in all.

The variables do not present any significant correlation problems, as demonstrated by the low variance inflation factor (VIF) values: maximum 3.33 and mean 1.94 and 1.82 depending on the model, all of which are much lower than the standard recommendation (below 10) in econometrics textbooks (Hair et al., 2013). The Doornik-Hansen test for normality multivariate has been applied to the two models and once again indicates the need for a Poisson specification. Also, the Levin-Lin-Chu test for non-stationarity shows that the panels do not

contain unit roots and are, therefore, stationary.

Interestingly, the fixed effects residuals (u_fe) show lack of significance, which is a reflection of the acceptance of the null hypothesis of exogeneity with respect to the idiosyncratic term. In other words, the fact that the null hypothesis of exogeneity cannot be rejected shows no evidence of endogeneity. This result supports the use of a classical Poisson regression model.

## 4. Discussion

The results in Table 3 enable us to test and confirm or reject our hypotheses developed in the previous section.

Regarding the hypotheses in groups 1 (tourism) and 2 (economic factors), it is plausible to think that, as a general rule, Michelin-starred restaurants are linked to tourists rather than local customers. This allows us to consider these restaurants as elements that foster a tourist destination's international appeal rather than a mere element of the local hospitality industry.

This would explain the existence of restaurants with two and three Michelin Stars in provinces with low incomes but a great appeal and potential for tourists, such as Cadiz and Caceres.

However, this rule requires some consideration. First, it does not refer to any kind of tourist whatsoever but to a particular kind with a very specific profile: foreign and linked to the luxury segment. This can be seen in the positive and high significant coefficient of the variable 5-star hotels.

We find two plausible explanations for this correlation: First, the fact that luxury hotels are evidently correlated with high-income tourists who demand this kind of restaurant and, second, as commented in the introduction section (e.g., SLH network), 5-star hotels often have haute cuisine restaurants.

In other words, there is a symbiotic relationship between 5-star hotels and Michelin-starred restaurants to the extent that the latter can trigger the opening of a hotel when no luxury accommodation facilities

**Table 2**

Variables and descriptive statistics.

| Variable (abbreviations) | Description | Obs. | Mean | Std. Dev. | Min. | Max. | Source |
|---|---|---|---|---|---|---|---|
| **Endogenous Variable** | | | | | | | |
| Number of Michelin-starred restaurants (Michelin) | Number of Michelin-starred restaurants, by province (Log) | 1000 | 2.678 | 4.433 | 0 | 32 | Michelin Guide |
| **Exogenous variable by category** | | | | | | | |
| **Tourism** | | | | | | | |
| Foreign tourists (Ftou) | Number of non-residents staying one or more nights at the same hotel, by province (Log.) | 1000 | 13.381 | 0.749 | 11.245 | 15.696 | INE |
| Domestic tourists (Dtou) | Number of Spanish residents staying one or more nights at the same hotel, by province (Log.) | 1000 | 12.275 | 1.554 | 9.259 | 16.082 | INE |
| **Economics** | | | | | | | |
| GDP per capita (GDP) | Per capita Gross Domestic Product by province (Log.) | 1000 | 3.146 | 0.212 | 2.811 | 3.75 | INE |
| Luxury hotels (Hotels5) | Number of 5-star hotel establishments by tourists by province | 1000 | 0.001 | 0.001 | 0 | 0.001 | INE |
| Agriculture | Weight of agriculture sector over total gross added value (%) | 1000 | | 0.042 | 0.001 | 0.223 | INE |
| Industry | Weight of industry sector over total gross added value (%) | 1000 | 0.185 | 0.074 | 0.048 | 0.394 | INE |
| **Michelin Guide Criteria** | | | | | | | |
| PDO | Number of Protected Designations of Origin (PDO) per km2 in the province | 1000 | 0.002 | 0.002 | 0 | 0.011 | Eurostat |
| Culinary Schools | Number of internationally-recognized International Culinary Schools per capita | 1000 | 0.001 | 0.001 | 0.001 | 0.001 | Chef's Pencil, Michelin, Eurhodip |
| R&D institutions | Number of Research & Development Institutions per capita | 1000 | 0.002 | 0.001 | 0.001 | 0.001 | INE |
| Restaurants | Number of restaurants per capita (Log) | 1000 | −5.001 | 0.178 | −5.628 | −4.346 | INE |
| **Instrumental variables for LW Procedure** | | | | | | | |
| CPI | Inter-annual variation of Consumer Price Index (CPI), by province (Log.) | 1000 | 0.021 | 0.016 | −0.015 | 0.055 | INE |
| WHS | Number of cultural World Heritage Sites (WHS) declared by UNESCO, by province. | 1000 | 1.845 | 1.362 | 0 | 5 | WHC -UNESCO |
| Temperature | Mean maximum temperature (°C), by province (Log.) | 1000 | 3.029 | 0.129 | 2.580 | 3.337 | AEMET |

Notes: National sources: INE (National Statistics Institute in Spain) | AEMET (State Meteorology Agency in Spain) -International sources: Michelin Guide | Eurostat (EU Statistical Office) | WHC (Wolrd Heritage Council, UNESCO) | Eurohodip | Chef's Pencil Source: Authors.

**Table 3**
Regression results.

| | FE_Poisson | | FE_LWP | |
|---|---|---|---|---|
| | (I) | (II) | (III) | (IV) |
| **Ftou** | 0.483 | – | 0.910 | – |
| | (0.142)*** | | (0.392)** | |
| **Dtou** | – | 0.216 | – | 2.018 |
| | | (0.211) | | (0.922)* |
| **Michelin_lagged** | 0.043 | 0.054 | 0.028 | 0.013 |
| | (0.016)*** | (0.016)*** | (0.021) | (0.024) |
| **GDP** | −0.988 | −0.727 | −1.121 | 1.132 |
| | (0.638) | (0.628) | (0.649) | (0.241) |
| **Hotels5** | 3970.638 | 3801.708 | 4016.007 | 3925.381 |
| | (836.38)*** | (770.956) | (843.258) | (774.752) |
| | | *** | *** | *** |
| **Culinary Schools** | 36810.64 | 85329.47 | 6953.677 | −11779.87 |
| | (75786.07) | (69816.36) | (73732.8) | (76484) |
| **PDO** | 701.881 | 652.664 | 388.255 | 742.176 |
| | (283.522) | (318.95)*** | (399.631) | (312.813)* |
| | ** | | | |
| **R&D** | 374.360 | 181.145 | 597.837 | −292.378 |
| | (139.008) | (172.077) | (223.748) | (284.852) |
| | *** | | *** | |
| **Agriculture** | 2.620 | 1.863 | 2.895 | 3.071 |
| | (2.686) | (2.696) | (2.716) | (2.664) |
| **Industry** | 3.082 | 1.518 | 4.706 | 3.881 |
| | (1.698) * | (1.705) | (2.607)* | (2.197)* |
| **Restaurants** | −0.013 | −0.280 | 0.063 | −0.660 |
| | (0.380) | (0.330) | (0.391) | (0.367) * |
| **u_fe** | – | – | **−0.455** | **−1.817** |
| | | | **(0.373)** | **(0.942)*** |
| **Province-fixed effect** | YES | YES | YES | YES |
| **Wald test (joint significance)** | 126.43*** | 113.83*** | 122.5*** | 112.03*** |
| **VIF (mean \| max)** | 1,94 \| 3,33 | | 1,82 \| 2,86 | |
| **Doornik – Hansen test for multivariate normality** | 21.069*** | | 20.974*** | |
| **LLC for non-stationarity** | | −2.7630*** | | |
| **No. Observations** | 900 | 900 | 900 | 900 |
| **No. Provinces** | 45 | 45 | 45 | 45 |

Note: Standard errors in parentheses. Statistical significance at 1% (***), 5% (**), 10% (*).
Source: Authors

exist in the hinterland. Such is the specific case of the two *Atrio* Michelin-starred restaurants in Caceres, which opened their own 5-star hotel to host their clients. In any case, these found synergies are compatible with the idea that the consumption and demand for the services of luxury hotels and Michelin-starred restaurants have their own particularities and differences.

Also, a positive and significant relationship seems to exist with the industry sector but not with agriculture. This might be due to the former being able to generate more stable employment with higher salaries for people with higher academic backgrounds, who would potentially form the clientele of these restaurants. However, the level of significance of this variable is not high (at 10%), which is in line with the lack of correlation between local income (GDP per capita) and Michelin-starred restaurants as they have greater links with foreign tourists than domestic tourists.

The non-significance of the agriculture variable coefficient means that the high importance of agricultural production does not guarantee high-quality ingredients, which is a major requirement for the Michelin Star award.

This is in line with the third group of hypotheses (Michelin Guide criteria). Here, a robust relationship seems to exist between gastronomic excellence and the quality of the inputs needed for the development of this kind of restaurant.

First, the number of Michelin-starred restaurants is clearly correlated

with the number of PDOs, which is an excellent proxy for the quality of the region's agricultural produce. PDO awards recognize the characteristics of the products that are produced, processed, and prepared in a specific geographic region (Bouamra-Mechemache and Chaaban, 2010), such as wine, olive oil, rice, cheese, and meat. According to our results, a wide offer of excellent —and internationally recognized— products fosters the existence of Michelin-starred restaurants, which eventually include them on their menus. It is plausible to think that international gastronomic tourism plays a role as a catalyzer of the link between these two variables (Marcoz et al., 2016).

Second, our results suggest the existence of a link between a province's innovation capacity (measured by the number of R&D institutions) and the number of Michelin-starred restaurants. The explanation for this relationship lies in the sophisticated, innovative, and high-tech culinary methods applied in the kitchens of these restaurants, such as gelification, spherification, and the use of liquid nitrogen. Innovation is the hallmark of these restaurants (Stierand et al., 2014), and some such as *El Bulli* run organizations whose main aim is to investigate the relationship between innovation and gastronomy (Elbullifoundation, 2021).

Nevertheless, it seems that there is no a strong relationship between the existence of top culinary schools in a province and the number of Michelin-starred restaurants. Although, as expected, this variable has a positive coefficient, its surprising lack of significance might be explained by the fact that these schools have a great ability to attract students from other provinces, regions, and even other countries. This implies that the students do not generally remain in the school's province but, rather, return to their home province/country. So that the real impact of top culinary art schools would be national or international rather than local. In other words, a sort of reverse brain drain takes place.

Finally, the results for the hypothesis related to the criterion of regularity and consistency are interesting. On the one hand, the high positive significance of the lagged variable (Michelin-starred restaurants) shows that an award obtained in any given year depends on the award received the previous year. In other words, gastronomic excellence follows its own narrow path with an upward trend. This result could justify the role that Michelin restaurants play as culinary schools for young professionals, sowing the seeds for new haute cuisine restaurants (see Zopiatis et al., 2021 about the relevance of hospitality internships). This is especially important in the framework of the controversial public debate around the conditions that these young professionals have to contend with during their traineeships in top restaurants, with low salaries and high stress (El Mundo, 2017). Chefs and restaurants usually justify these conditions with the high value of the academic and professional education that the trainees receive, which is in line with our results.

On the other hand, we find no evidence for the hypothesis that the total number of generic restaurants in a province can boost the likelihood that it will be awarded a new Michelin Star. This coincides with a general idea shown by the previous results: it is quality that matters rather than quantity (e.g., PDO vs agriculture sector).

## 5. Conclusions

Given the relevance and impact of Michelin-starred restaurants on gastronomy, hospitality and tourism industry and even economic development, in this paper, we have tried to identify the main factors and determinants that affect the options for regions to accumulate these awards.

Our paper focuses on the case of Spain, whose gastronomy is a competitive advantage in the development of its tourism and sign of identity of its regional destinations. To assess the main determinants of having Michelin-starred restaurants, the econometric technique of panel data has been applied to 50 Spanish NUTS-3 regions (excluding Ceuta and Melilla due to their small size) for the years 2000–2019 (pre-covid period).

The following conclusions can be drawn from the above-commented results. Firstly, Michelin-starred restaurants are skewed towards an international clientele rather than local customers. This is demonstrated by both the higher coefficient with a statistical significance at 1% of the foreign tourist variable and the lack of significance of economic variables such as local income (GDP per capita). International exposure and recognition of the Michelin brand mean that places with a greater concentration of foreign tourists and a higher degree of internationalization are more likely to accrue a greater number of Michelin Stars. In this sense, policymakers and tourism managers could implement promotional activities that drive the internationalization of tourist destinations. For example, synergies should be studied with the joint promotion, by marketing campaigns, of any other international awards that a destination possesses, such as the Blue Flags or UNESCO World Heritage Sites that have been proved to be highly esteemed by international tourists.

In this line, a way of developing marketing campaigns for the tourism destinations and promoting both tourism and gastronomy quality could be the use of top Michelin-starred chefs as a part of their national or international marketing campaigns, both in traditional media formats, social networks and through their participation in international trade fairs, exhibitions or gourmet food and wine tastings in other regions or countries, or indirectly, in more sophisticated events, as for instance, cooking in international political events that are worldwide broadcasted. A good example was the dinner organized inside the Prado Museum by top chefs José Andrés and Paco Roncero during the NATO Summit in Madrid in 2022. Besides the political aims, this events were seeking to enhance the image of Spain abroad, especially as a tourist destination that combine excellent culture and gastronomy.

In short, the Michelin chefs, particularly those with highest media attention, can play an important role as destination ambassadors, both in orthodox and heterodox marketing destination campaigns.

Secondly, quality rather than quantity is what matters in terms of achieving and accruing Michelin-starred restaurants. This is demonstrated by the significance of some quality-related variables such as PDO (statistical significance at 5%) and R&D (statistical significance at 1%) and the lack of significance of quantitative proxy variables such as the total number of restaurants or those that are purely economic. In fact, contrary to expectations, there is greater synergy, albeit barely statistically significant (at 10%), with the industry and construction sectors than with the primary sector (agriculture + livestock + fisheries).

Thirdly, our results demonstrate the significant and positive value of informal training by hospitality internships. From the point of view of local development, it seems that the best place for apprentices to learn their trade are the existing Michelin-starred restaurants themselves, even in preference to local culinary schools. Destinations managers should promote and encourage the knowledge transfer from the own Michelin-starred restaurants to apprentices by ensuring vocational training on these venues.

Finally, a virtuous circle has been shown to exist in luxury hospitality industry. Michelin-starred restaurants and 5-star hotels need and complement each other. Synergies can be found in genuine luxury and excellence ecosystems. Good examples that illustrate this hypothesis could be the case of the already mentioned *Atrio* restaurant in Caceres, which opened its own 5-star hotel to host its clientele, and the *Marqués de Riscal* Michelin-starred restaurant, which is located in the prestigious Spanish PDO winery's 5-star hotel designed by the world-famous architect Frank Gehry. Destination managers, who are normally willing to promote the luxury tourism segment (behind the euphemism of "quality tourism"), should consider joint actions to promote luxury ecosystems as a whole instead of focusing on individual elements that eventually lead to "luxury islands".

Fig. 4 summarizes our results and conclusions by indicating if the hypothesis have been confirmed (✓) or not (x).

A future line of research would be to continue exploring the boundaries of this luxury hospitality ecosystem, with the inclusion of some new elements such as marinas, motor-racing circuits, and Congress Halls where major international conferences such as the Mobile World Congress and the Consumer Electronics Show (CES) are held, to give just some examples, as drivers for the improvement of the image's destinations.

**Implications to gastronomy**

The novelty of this paper, which is to date the first to address the factors and determinants that enable destinations to accrue Michelin-starred restaurants, brings major implications for the gastronomy field.
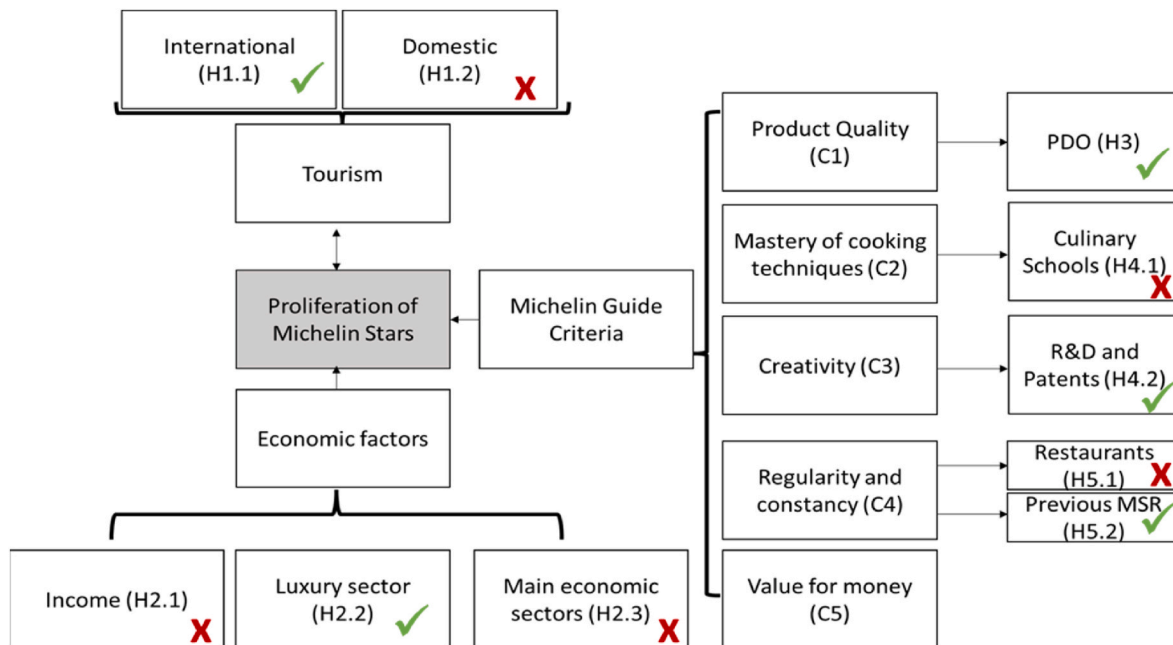


**Fig. 4.** Hypothesis validation.
Source: Authors.

First, it highlights the role of Michelin chefs, particularly those with highest media attention, as destination ambassadors as long as they develop a high quality gastronomy environment in its region.

Second, it reveals that the combination of product quality (e.g. PDOs) and research and innovation in tools and techniques (number of R&D institutions as a proxy of innovation) are necessary to develop a haute cuisine culture, and therefore, to Michelin Stars.

Thirdly, the results support the significant and positive value of informal training by hospitality internships. From the point of view of local development, the existing Michelin-starred restaurants seem an optimal place for apprentices. Gastronomy industry managers (among others) should promote and encourage the knowledge transfer from their own Michelin-starred restaurants to apprentices by ensuring vocational training on these venues.

Nevertheless, it seems that there is no strong relationship between the existence of top culinary schools in a province and its number of Michelin-starred restaurants. The real impact of top culinary art schools would be national or international rather than local.

Finally, it shows how the Michelin world is closely related to luxury ecosystems. In other words, synergies can be found in genuine luxury and excellence ecosystems. It has important managerial implications in the hospitality and gastronomy world and key players in the industry (destination managers, hospitality professionals, chefs …) should consider joint actions to promote luxury ecosystems as a whole instead of focusing on individual elements that eventually lead to "luxury islands".

## Credit author statement

**Jose I Castillo-Manzano:** Conceptualization; Methodology; Supervision; Writing - Original Draft; Writing - Review & Editing.

**Alvaro Zarzoso:** Data curation; Software; Methodology; Formal analysis; Writing - Original Draft.

## Declaration of competing interest

All authors declare that they have no conflicts of interest to disclose.

## Data availability

Data will be made available on request.

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