Stardust over Paris Gastronomic Restaurants*

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Abstract

The objective of this paper is to understand the influence of expertise in gastronomy. We start by analyzing how experts value chef's performance with respect to other non artistic components (e.g. venue). We then show how the evaluation impacts the market price structure. Using some spatial econometric models, applied to the case of Paris gastronomic restaurants, we show that location matters in the attribution of stars, even if Michelin claims the opposite. Furthermore, these rewards allow the awarded chefs to charge a price premium of about 25%. This premium is shown to spread over all restaurants in the neighborhood.

Keywords: Hedonic prices, Gastronomy, Spatial econometrics
JEL Codes: D4, L15, L66

1 Introduction

In a recent paper, Ginsburgh (2003) emphasized the prominent influence of experts in economics, stating that "*The role of gatekeepers, gurus and experts is dramatically increasing in our societies, where sorting information about quality can become a very cumbersome task [...] In the field of cultural economics, prominent examples of expert judgment include the award of an Oscar by the Academy of Motion Picture Arts and Sciences, the opinion by an art expert to attribute a painting to Rembrandt or the rating of a wine by Robert Parker*".

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In the strand of literature dealing with expertise, a central question is to what extent do expert opinions reflect the underlying fundamentals of value.

In gastronomy expertise plays an important role since it provides information, at a reasonable cost, that could not be identified solely by customers. Indeed guidebooks are supposed to visit frequently geographically scattered restaurants to assess their performance. This induces huge search costs that could no be afforded by each single client. A major drawback in gastronomic expertise is that quality is not fully objective. Chossat and Gergaud (2003), for example, have shown that Gault-Millau restaurant ratings do not exclusively reflect the talent of chefs but also environmental, non-artistic, elements such as the venue or the choice of wines in cellars. The most influential guidebook for French gastronomic restaurants is, without any doubt, the Michelin Red Guide which sells approximately 400,000 copies a year in France and around one million in Europe. But this guide is in the heart of a severe polemic since renowned chefs, such as the former three-star Alain Senderens, gave back their Michelin reward claiming that they renounce to this *luxury that suffocated them*[1], *to allow more freedom to the cuisine [...] and to reduce the bill*[2]. Another former three-star and renowned chef, Joël Robuchon, even states that[3] Michelin's image is in bad shape and refuses his restaurants to be listed in the guidebook, considering that they do not match with *the passeist and ostentatious criteria used by the Michelin.* The present director of Michelin, Jean-Luc Naret, states that *stars are in plates and only in plates.* He affirms that *the guidebook never incited chefs to invest in anything else than food.* Several young promising chefs (such as David Zuddas or Gilles Choukroun among others) along with well established ones (such as Joël Robuchon, Alain Senderens or Philippe Gaertner among others) claim the opposite. They say that to keep a star, huge investment in decor and service are mandatory. Famous gastronomy critic François Simon, even compares (in Le Nouvel Observateur[4], August 17^{th}, 2005) the Michelin

[1] V. Noce in *Libération* citing Senderens, September, 23^{rd}, 2005

[2] J-C Ribaut in *Le Monde* citing Senderens, June, 3^{rd}, 2005.

[3] Cited by J-C Ribaut in *Le Monde*, June, 3^{rd}, 2005.

[4] One of the leading french newspaper.

with the Pravda and declared *the Michelin is a mirror of the* [*French*] *political society, it consecrates places where the nomenklatura goes to [...].*

To settle this quarrel, we try to empirically understand how the guidebook selects and rewards restaurants and how stars affect prices. Unfortunately, contrarily to the Gault-Millau guidebook used in Chossat and Gergaud (2003), the Michelin guidebook does not provide any comment on the characteristics used to assess quality of food. To overcome this problem, we merge the information coming from the Red Guide, with the one contained in the Zagat Survey Guide which is based on consumers' opinion on cuisine, decor and service.

The specific objective of this paper is twofold.

First, we want to identify variables that increase the probability of being awarded a Michelin star and check whether non-artistic environmental criteria, such as location, are relevant. *A priori*, there is no reason for the probability of being awarded a star, to be higher in wealthier areas than in popular arrondissements. We test for this using a spatial logit model.

Second, we want to quantify the impact that a star has on the price charged by the awarded restaurant itself and by neighboring restaurants. Albeit one expects the award to attract newcomers[5], it may also discourage some *habitués* who become reluctant to pay the star premium and look for similar, less expensive, non-starred restaurants.[6] As a consequence, the neighbors will potentially face an increasing demand and update their prices accordingly. This effect should logically fade away along with distance. To test for this, we use an hedonic spatial econometric model where the dependent variable is the (logarithm of the) representative price of restaurants and the covariates are, on the one a set of control variables and on the other, a variable identifying the percentage of starred restaurants in the neighborhood of each individual.

The data used cover a sample of restaurants located in Paris *intra muros* area. Paris was chosen since it is the place in France, where the biggest cluster

[5] Since it can be perceived as a signal of quality or a kind of risk insurance premium

[6] For example a restaurant offering a quite comparable cuisine with a less luxurious and therefore costly cadre.

of first-rank chefs can be found. One-third (9 out of 26) of the French icon or three-star restaurants were located in Paris intra-muros in 2006. Restaurants of all nationalities, all specialities, all venues at about any price can be found in the French capital. Given this extreme differentiation in price and quality, an hedonic approach is particularly well suited since it allows to identify the contribution of each characteristic on price formation[7].

The paper is organized as follows. Section 2 presents some stylized facts. Section 3 describes the data. Section 4 sets out the methodology and Section 5 presents the results. Section 6 draws some conclusions.

2 Stylized facts

Before describing the data in details, it is interesting to look at some stylized facts. In Figure 1, we present a map of Paris, highlighting the percentage of starred restaurants (available in the sample) for each arrondissement. We immediately see that the 8^{th} and the 18^{th} arrondissements are those presenting the highest share of starred restaurants since they both have more than 20% of their restaurants recommended by the Michelin guidebook.[8] More generally, the Eastern part is less "starred" than the Western part. Interestingly, it is also the place where the most popular arrondissements are located[9].

In Table 1, we present in 5 consecutive columns the arrondissement identification number ($Arr.$), the number of available observations ($Obs.$), the average price ($Mean$) in Euros, the standard deviation ($s.d.$) of prices and, to have an idea of the relative price dispersion, the coefficient of variation ($C.V.$).

[7] A similar hedonic pricing equation has been estimated to explain the average price of dinners at 54 New Orleans restaurants (see Falvey, Fried and Richards, 1992 for more details).

[8] Note nevertheless that there are only four restaurants in the sample are located in the 8^{th} arrondissement and that only one out of these restaurants is starred.

[9] As an illustration of these differences, think that in 2002 (fourth semester) a square meter in an historical building located in the 7th arrondissement (West) was worth more than twice as much as the same surface in a comparable building of the 19th arrondissement (East): 5481 versus 2528 euros respectively (Source: Chambre des Notaires and Insee, Paris).

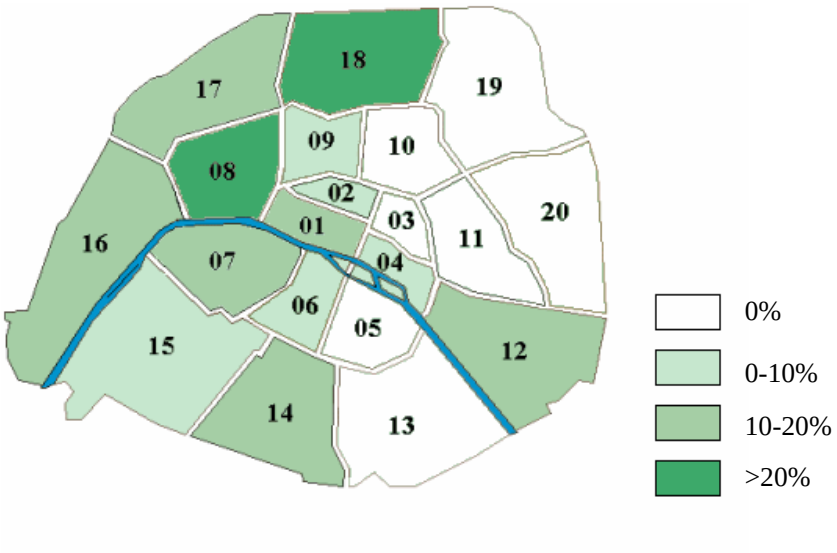

Figure 1: Percentage of Michelin Star % by Arrondissement

Table 1, Observations by "Arrondissement"

Arr.	*Obs.*	*Mean*	*s.d.*	*C.V.*
1	59	45.34	21.55	0.48
2	19	40.76	13.65	0.33
3	18	39.27	14.19	0.36
4	34	39.07	18.55	0.47
5	31	37.65	8.67	0.23
6	58	42.20	14.12	0.33
7	59	46.76	19.68	0.42
8	82	56.12	24.34	0.43
9	25	40.70	10.56	0.26
10	7	37.24	7.11	0.19
11	25	33.96	7.28	0.21
12	9	43.23	19.20	0.44
13	8	34.62	7.29	0.21
14	18	46.12	17.59	0.38
15	29	44.57	15.10	0.34
16	42	50.57	17.79	0.35
17	38	49.14	18.58	0.38
18	4	52.14	24.54	0.47
19	5	41.37	12.25	0.30
20	1	37.50	.	.
Total	571	45.22	18.65	0.41

From Table 1, we see that the most homogeneous-in-price arrondissements are the 5^{th}, the 10^{th}, the 11^{th} and the 13^{th}. Remark that these arrondissements do not have any starred restaurant. This tends to show that expertise and price heterogeneity are not independent. Note also that the average price in the neighborhood[10] of starred restaurants is significantly higher than the average price in the neighborhood of "regular" restaurants[11].

All these facts tend to support our conjectures presented in the introduction. First, stars are apparently not exclusively attributed according to food quality. Indeed, Michelin ranked restaurants are not distributed randomly over the territory, suggesting that location matters. Second, prices seem to be influenced by the Michelin award. Third it looks as if a spillover effect of prizes from starred restaurants over their neighbors exists. This is tested in more formally further on.

3 The Data

The dataset covers all Paris restaurants surveyed by Zagat in 2002. Zagat Survey(R), is the world's leading provider of consumer survey-based leisure content[12]. The Zagat Surveys are unique in that they separately rate the distinct qualities of a restaurant –food, decor and service– based on consumers input. The premise of this guidebook is that rating a restaurant on the basis of thousands of experiences is inherently more accurate than relying on a single reviewer. In the guidebook, the average price that is normally charged for a dinner with one drink (tip included) is available, on the basis of the cost declared by a significant number of clients[13]. Each consumers' questionnaire

[10] Defined as a weighted average of prices in the restaurants that are in a radius of 3.7 km, with the weight that is a linearly decreasing function of the distance.

[11] The $|t - stat|$ associated to the test of equality of means, by groups with unequal variances is 5.45 clearly leading to a rejection of the equal means hypotheses.

[12] For the dining industry, 2006 is the 28th year of uninterrupted existence.

[13] It is thus an actual average price payed and then reported by consumers and not a perceived price.

is compiled by Zagat's content department in conjunction with expert editors. The questionnaires are posted on Zagat's Web site, where consumers provide their ratings and reviews. An independent data processor compiles the votes. To guarantee that the average score is a representative measure, the editors specify if the mean price is calculated on a large number of surveys or not[14].

Food, decor and service are rated on a scale ranging from 0 to 30 following the definition described in Table 1:

Table 1: Zagat ranking	
$26-30$	extraordinary to perfection
$20-25$	very good to excellent
$16-19$	good to very good
$10-15$	fair to good
$0-9$	poor to fair

Once the data coming from Zagat have been retrieved, the dataset is merged with the information available from Michelin. In such a way it is possible to have the information for average prices and quality as perceived by consumers and link them to the attribution of Michelin stars.

4 The Methodology

The first goal of the paper is understanding if the attribution of Michelin stars is related to non-artistic determinants, such as the percentage of starred restaurants in the neighborhood. The second goal is measuring how prices are dependent on stars awarded and on the number of starred restaurants in the neighborhood.

In our dataset, we identify the geographical coordinates of all restaurants[15]

[14] In the empirical analysis it turns out that this variables does not have any impact on prices.

[15] The coordinates are available in decimal degrees from maporama.com and are converted into distances (km) to the equator and to the greenwhich meridian through the formula: $distance = \frac{6378.137 \cdot \pi \cdot degrees}{180}$.

and compute the distance between each pair of observations. The maximal distance between two restaurants in the dataset is $18.5km$, the largest minimum distance is $1.67km$ and the smallest maximum distance is $9.34km$. Several strategies could then be adopted in the definition of neighbors. In general terms we attribute proximity spatial weights in accordance to the function:

$$w_{ij} = \begin{cases} 0 & if\ d_{ij} \notin (l_b, u_b] \\ 1/d_{ij}^f & if\ d_{ij} \in (l_b, u_b] \end{cases}$$

where (i, j) denotes the location pair, d_{ij} denotes the Euclidean distance between restaurants i and j, l_b denotes the lower bound of the specified distance band, u_b denotes the upper bound of the specified distance band, and f denotes a positive friction parameter. In all our definitions, the friction parameter will be set equal to one[16]. Finally, the values in the weighting matrix are standardized in order to ensure that the sum of all elements per row sums to one.

In a first definition of neighbors, we consider all restaurants in the dataset as being neighbors but consider that the degree of proximity between them is a linearly decaying function of the distance. In this case the lower bound l_b is equal to zero and the upper bound u_b is equal to 18.50. We call the resulting spatial weighting matrix W_1. In a second definition, we consider as neighbors of a given restaurant, all restaurants that are in a range of 5.5 km, that is to say the third quartile distance. We call the weighting matrix associated to it W_2. In a third definition, we consider as neighbors all restaurants that are in a range of 3.7 km, that is to say the median distance. We call the weighting matrix associated to it W_3. Finally, in a fourth definition, we consider as neighbors of a given restaurant, all restaurants that are in a radius of 2.3 km, that is to say the first quartile distance. We call the weighting matrix associated to it W_4.

Once we have the weighting matrix, it is easy to calculate the weighted average number of "starred" restaurants (in the neighborhood of each restaurant)

[16] In such a big city, the transportation cost is lump-sum while time depends linearly on distance. The aggregate movement cost can thus be considered as linearly dependent on the distance travelled.

by simply multiplying the weighting matrix (that we generally call W from here on) by the vector identifying the restaurants awarded a Michelin star (called $STAR$ in this application). In other words, the frequency of "starred" restaurants in the neighborhood of each restaurant is defined by $W \cdot STAR$ (called vector $WSTAR$ from hereafter). Since the vector is by construction strictly superior to 0 in all specifications, we take the ln of $WSTAR$, to work with elasticities rather than unit changes.

To test if the attribution of a star is a function of non-artistic components, and more specifically of the number of starred restaurants in the neighborhood, we start by calculating Moran's I[17] on the $STAR$ variable (conditional to the distance). We then run a simple spatial logit, where the dependent variable is a dummy identifying if the restaurant is starred. For the covariates we use $\ln WSTAR$ as a variable identifying the weighted percentage of starred restaurants in the neighborhood and a set of control variables X. To ensure parsimony, we do not consider all the control variables available in the dataset. We only keep the ones that turn out to be significantly different from 0 after a stepwise (backward) selection procedure (at 5%). The complete set of variables on which we run the selection procedure are: an identifier of the restaurants selected by the Michelin guidebook, a dummy highlighting if the cooking can be considered as "haute cuisine" as stated in Zagat, consumers' ratings on the quality of food, the quality of service and the quality of the decor as well as the homogeneity in prices (again as seen in the Zagat guidebook). We furthermore consider arrondissements fixed effects, restaurants characteristics[18] and the regional origin of the cooking. For the sake of clarity we do not present the estimated coefficients for all control variables that remain significant and rather concentrate on the ones we are interested in. It is important to note that $\ln WSTAR$ is among the most significant variables in all specifications.

From an econometric viewpoint, the estimated relation will be of the type:

[17] Moran's I is the slope of the regression line between $WSTAR$ and $STAR$.

[18] As for example the restaurants' speciality (e.g. seafood) or having an interesting view.

$$STAR = \beta_1 X + \beta_2 \ln WSTAR + \varepsilon \quad (1)$$

The estimated coefficients as well as their degree of significance are presented in Table 2.

As far as price formation is considered, Rosen's (1974) Hedonic Price Modelling is commonly used when products are vertically differentiated. Among other restrictive hypotheses[19], this model assumes that characteristics are objectively measured[20]. According to the author, hedonic prices are defined as the implicit prices of attributes and are revealed to the agents from observed prices of differentiated products and the specific amounts of characteristics associated with them. Econometrically, implicit prices are obtained by regressing the observed product price p on its characteristics $z = (z_1, z_2, ..., z_n)$, with z_i measuring the amount of the ith characteristic contained in the good. As indicated by Rosen (1974) and reasserted later by Nerlove (1995), the hedonic prices vector is determined both by the distribution of consumer tastes and the distribution of producer costs. Therefore, apart from a few specific cases, when supplies are exogenously determined[21] or when consumers face exogenous prices (cf. the Swedish wine market case analyzed by Nerlove, 1995), implicit prices are difficult to interpret and do not reflect exclusively consumers preferences. Although based on a series of very restrictive hypotheses (perfect information, objective quality, etc.) the applications of this method, and in particular the ones consisting in estimating the hedonic price equation are numerous and varied : automobiles (Court, 1939 ; Griliches, 1961,...), housing (e.g. Collazos et al. 2006), computers (e.g. Griliches and Hamermesh, 1994 ; Berndt et al., 1995), paintings (e.g. Chanel et al., 1996), wines (e.g. Di Vittorio and Ginsburgh, 1996

[19] In particular, agents have perfect information and face a "spectrum of products". Choice among various combinations of z is continuous.

[20] The characteristics are objective, but consumers may differ in their subjective valuations of alternative packages.

[21] This is the case among others for environmental amenities (see Ohsfeldt, 1988), automobile equipments (see Ohsfeldt and Smith, 1985) and for computer characteristics (see Smith et al., 1990)

; Combris et al., 1997 ; Landon and Smith, 1997), classical music (Harchaoui and Hamdad, 2000), etc.

The estimated relation will be of the type:

$$\ln P = \beta_1 X + \beta_2 \ln WSTAR + \varepsilon \tag{2}$$

where X is the matrix containing the set of control variables, that passed the 5% threshold of significance in the stepwise procedure considering the same control variables summarized previously. β_1 is the vector of coefficients that need to be estimated. This relation can be efficiently estimated by OLS if the error term is not serially correlated. Or more specifically if $\lambda = 0$ in the specification of the error of the type: $\varepsilon = \lambda W\varepsilon + u$ where u is a well behaved disturbance. For all specifications we present the LM statistic associated to the assumption that the spatial autocorrelation of the error term is zero. It is important to note that here again, $\ln WSTAR$ remains among the most significant variables in the selection procedure, whatever the weighting matrix used.

5 Results

Moran's I, calculated at several distances, estimated on the variable $STAR$, shows that there is a positive spatial correlation for small distances and a negative one for large distances[22]. In Figure 2, we plot this statistic for a range of $10km$. A confidence interval (at 5%) is graphed to show when this statistic is significantly different from zero. The result tends to support the idea that restaurants are clustered. Starred and non-starred restaurants tend to be dispatched in two separate, homogeneous, geographical locations. Looking at figure 1, we see that the cluster of starred restaurants is in the Western part while the cluster of non starred restaurants is in the Eastern part. This could be a first element suggesting that Michelin considers the location as important and does not attribute stars all over the territory with the same likelihood.

[22] Results remain unchanged when cosidering the number of star awarded.

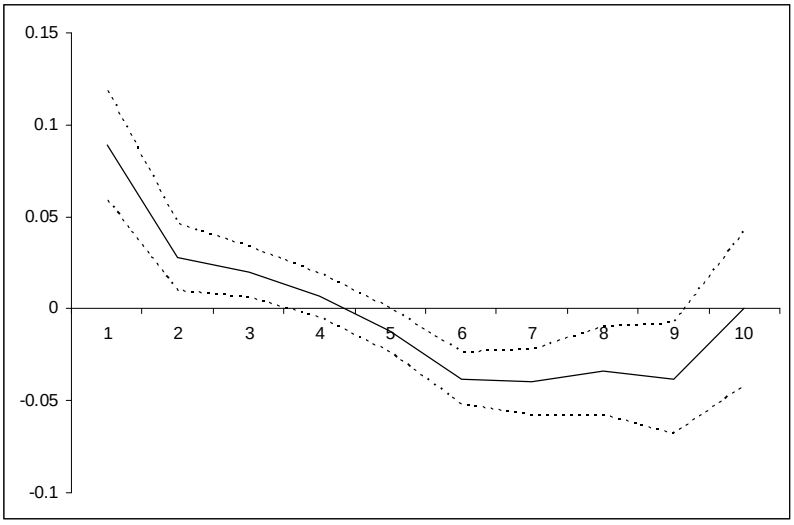

Figure 2: Spatial autocorrelation of starred restaurants (Moran's I)

This first evidence is strengthened by the fact that, in the stepwise procedure, the percentage of starred restaurants in the neighborhood remains significant. Independently of quality (decor and food), location plays a significant role in the attribution of stars. As far as quality is concerned, we find that service does not matter and that food has a greater impact than decor. It is evident that the perception of quality can be influenced by a Michelin star. Although the coefficients related to the perception of quality will be somehow biased, this will not affect the estimates we are interested in (i.e. $\ln WSTAR$), since the correlation between the percentage of starred restaurants in the area and the perceived quality of food is lower than 10%.

Table 2: Dependent Variable: STAR

	W_1	W_2	W_3	W_4
Ln(% of Stars in the Area)	2.66 ***	1.45 **	1.64 ***	1.25 ***
	(4.42)	(2.34)	(4.70)	(4.24)
Quality of Decor	0.33 ***	0.32 ***	0.33 ***	0.32 ***
	(7.53)	(7.89)	(8.02)	(8.31)
Quality of Food	0.81 ***	0.79 ***	0.80 ***	0.80 ***
	(11.22)	(12.41)	(11.40)	(11.76)
Constant	−16.55***	−18.57***	−18.66 ***	−19.18***
	(8.16)	(8.49)	(10.08)	(10.43)
Observations	571	571	566	552
Pseudo-R^2	0.66	0.65	0.67	0.66

Robust z statistics in parentheses

*significant at 10%; ** significant at 5% ; *** significant at 5%

In Table 2, we present the estimation results for the hedonic price equation[23]. We find first that, being selected by the guidebook, is associated to a price increase of 8% and that starred restaurants charge, on average, about 25% more than their competitors. Second, there is evidence of a spillover effect of prices, since the coefficient of $\ln WSTAR$ is positive and significant (in all specifications). The coefficient ranges from 5% to 13% for W_1 and W_4 respectively. This result was expected since under W_1 the market is much larger and a 100% increase in the percentage of starred restaurants generates a much larger potential residual demand. Finally consumers opinions on decor, service and food have a positive significant effect on prices. Although an endogeneity bias could distort the results related to the perception of quality, since the coefficient point in the expected direction, we conclude that perceived quality influences prices positively. In any cases, this will not affect the coefficients associated to variables we are mostly interested in (i.e. the first three variables in Table 3).

[23] The number of observations vary across specifications since only restaurant that have at least one neighbor are kept in the analysis.

Table 3: Dependent Variable: Ln(Price)

	W_1	W_2	W_3	W_4
Cited in the Michelin Guide	0.08***	0.08***	0.08***	0.08***
	(4.29)	(4.06)	(4.17)	(4.12)
Michelin Star	0.23***	0.23***	0.22***	0.22***
	(6.37)	(7.32)	(7.12)	(6.96)
Ln(% of Stars in the Area)	0.13***	0.07***	0.07***	0.05***
	(5.42)	(4.42)	(6.74)	(5.11)
Haute Cuisine	0.13***	0.12***	0.13***	0.13***
	(2.63)	(3.08)	(3.54)	(3.24)
Quality of Decor	0.02***	0.02***	0.02***	0.02***
	(8.85)	(11.26)	(11.04)	(10.23)
Quality of Service	0.01***	0.01**	0.01***	0.01***
	(2.66)	(2.62)	(3.15)	(3.08)
Quality of Food	0.03***	0.03***	0.03***	0.03***
	(7.93)	(10.56)	(10.95)	(10.43)
Heterogeneity in Opinions	0.08***	0.08***	0.08***	0.08***
	(4.53)	(5.66)	(5.72)	(5.83)
Constant	5.01***	4.86***	4.88***	4.81***
	(66.87)	(72.02)	(77.12)	(80.92)
$LM-test, \lambda = 0$	0.06	0.26	0.18	0.17
$p-value$	(0.80)	(0.61)	(0.68)	(0.68)
$Observations$	571	571	566	552
$R-squared$	0.75	0.75	0.75	0.75

Absolute value of t statistics in parentheses
*significant at 10%; ** significant at 5% ; *** significant at 5%
Controlling for Arrondissement Fixed Effects, Food Geographical Origin, Venue Specificity and Type of Restaurant

6 Conclusion

The objective of this paper is to understand the influence of expertise in gastronomy. We start by analyzing how experts behave and value artistic (e.g. chef's performance) and non artistic components (e.g. venue) when evaluating restaurants. We then show how evaluations impact market's price structure.

Using some simple spatial econometric models, applied to the case of Paris gastronomic restaurants, we show that the famous Michelin Red Guidebook is very influential. In particular, it leads to an increase in prices for the rewarded restaurants of about 25% that spreads over prices charged in the neighborhood. Even more, the simple fact of being selected in the guidebook generates a price premium of 8%. Furthermore, we find that independently of the level of perceived quality, the likelihood of being awarded a Michelin star is larger in

arrondissements where the share of starred restaurants is important. In the case of Paris, these neighborhoods are the most luxurious ones. A major drawback of this system, is that, independently of talent, it tend to favor chefs that have the financial potential of investing in luxurious surroundings or in the venue. As shown by Akerlof (1970) in the second hand car industry, this will have a negative effect on quality supplied in the market. Another disadvantage is that once stars are attributed to some restaurants, the induced inflation spreads all over restaurants in the area, constraining consumers to pay a star premium even in non-starred restaurants. There is therefore a stardust over Paris Gastronomic restaurants.

These results match those obtained by Ginsburgh and Van Ours (2003) for music, in the sense that selection depends partially upon non-artistic criteria and that expertise strongly determines future success. In the case of musical contest, the order of appearance turned out to be important to win the contest, and winning the contest leads to success in the following career. In the case of gastronomy, location is important to be awarded a Michelin star, and a Michelin star induces higher profits in the long-run.

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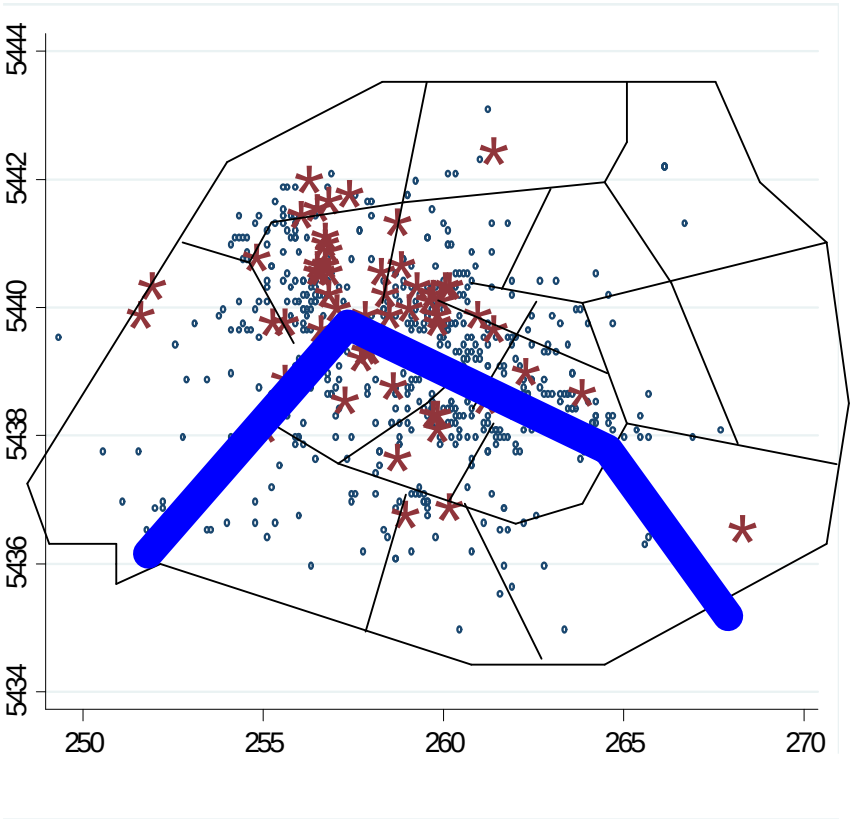

Figure 3: Restaurants in Sample