Menu Pricing for a New Italian Restaurant in New York City
IMRAD format with just exploratory data analyses

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Abstract

We address the question of how to set menu prices for a new high-end Italian restaurant in New York City. We examine data on Italian restaurants in Manhattan collected by Zagat (2001), using exploratory data analyses presented by Sheather (2009). We find that the average price of dinner is highly influenced by customer ratings of Food and Service, and somewhat less by Decor. The effect of location (east or west of Fifth Avenue) is more ambiguous. The maximal rating on each category is 24 or 25 out of 30, so there is room for a restaurant even more highly rated on all these dimensions. The restuaurant would be competitively priced if the average dinner price was in the \$60–\$70 or so range.

1 Introduction

The restaurant market in any city is competitive and difficult to thrive in, and driven by customer perceptions as much as any other quality. How should menu prices for a new restaurant be set?

This question is especially critical in the highly competitive New York City market, where we have been asked to suggest prices for a new Italian restaurant's dinner menu that are consistent and competitive with other high-end Italian restaurants in Manhattan, in or north of the Flatiron district. In particular, "The stated aims of the restaurant are to provide the highest quality Italian food utilizing state-of-the-art décor while setting a new standard for high-quality service in Manhattan. The creation and the initial operation of the restaurant will be the basis of a reality TV show for the US and international markets (including Australia)" (Sheather, 2009, pp. 5–6).

In addition to answering the main question posed above, we will address the following questions:

- Which customer perception has the largest effect on pricing?

- Should the restaurant be located east or west of Fifth Avenue, to maximize menu prices?

- Can we set a "price premium" (i.e., higher price) for "setting a new standard for high quality service in Manhattan" for Italian restaurants?

- Are there any restaurants that seem unusually high- or low-priced[1], given customer perceptions?

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[1]These are outliers, in common Statistical parlance.

The data, and the entire problem as stated above, are presented in Example 1.2.3, pp. 5–7, in Sheather (2009).
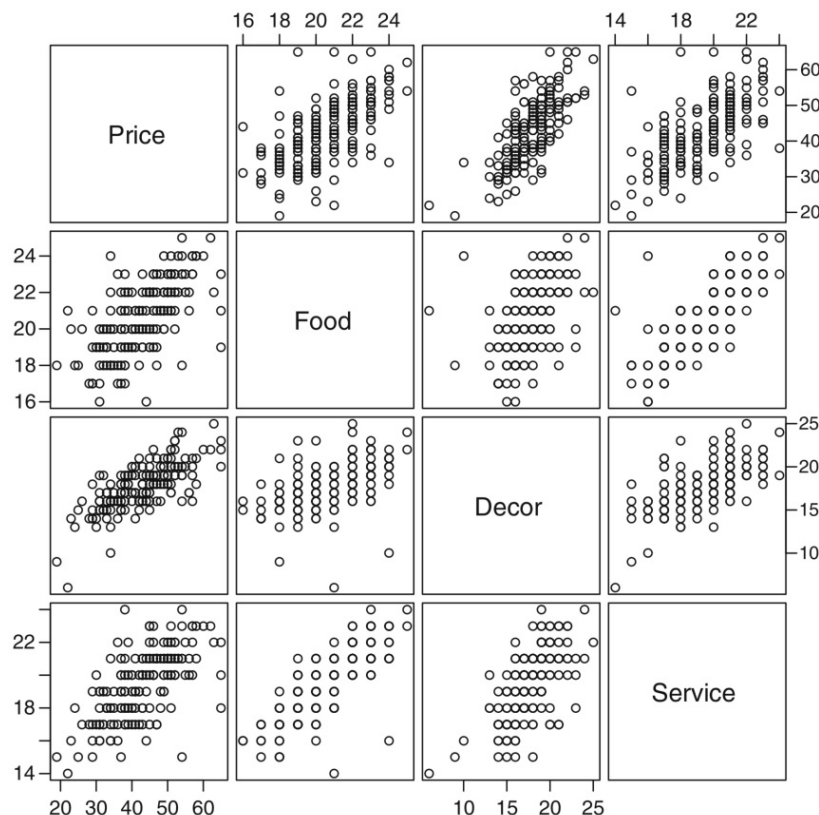
2   Methods

Figure 1: Scatterplot matrix of Price, Food, Décor, & Service ratings. From Sheather (2009, p. 7).

The data for this study come from Zagat (2001). Several surveys were conducted of Italian restaurants in or north of the Flatiron district in Manhattan in New York City. The reader should refer to Zagat (2001) for definitions, eligibility, inclusion/exclusion criteria, and so forth, for these surveys.

In all, 168 restaurants are represented in the data available to us, and the following variables were measured on each:

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\begin{aligned}
Y &= \text{Price} = \text{the price (in \$US) of dinner (including one drink \& tip)} \\
x_1 &= \text{Food} = \text{customer rating of the food (out of 30)} \\
x_2 &= \text{Décor} = \text{customer rating of the decor (out of 30)} \\
x_3 &= \text{Service} = \text{customer rating of the service (out of 30)} \\
x_4 &= \text{East} = \text{dummy variable} = 1 \ (0) \text{ if the restaurant is east (west) of Fifth Avenue}
\end{aligned}
$$

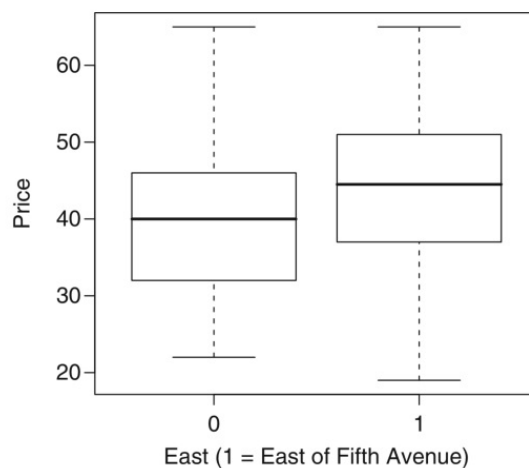The data are available in the file `nyc.csv`, in the online supplement accompanying Sheather (2009).

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Figure 2: Box plots of Price for two levels of the dummy variable East. From Sheather (2009, p. 7).

For our analysis we relied on visual comparison of exploratory scatter plots and box plots[2] (Figures 1 and 2 in this report) provided by Sheather (2009, p. 7), using the R language and environment for statistical computing (R Core Team, 2017). In order to identify restaurants with unusual/outlying pricing, we have also examined the raw data in `nyc.csv`.

3 Results

We can crudely estimate the slope of a (univariate) regression of Price on each rating variable, by dividing the plotting range of Price by the plotting range of each rating variable, estimated by eye from the scatterplots in Figure 1. The estimated slopes are 5.0 (Food), 2.67 (Décor), and 4.0 (Service). Thus, apparently, the Food rating has the biggest influence on Price (with a $5 increase in price associated with each 1-point increase in rating), followed closely by Service, and somewhat more distantly by Décor.

We can examine the influence of Service rating on Price more carefully by examining the scatter plot in the upper right in Figure 1). As noted in the previous paragraph, there appears to be a strong increasing relationship between Service rating and Price. Moreover, there is scope for creating a restaurant with higher sService ratings than any in the the Zagat survey: the highest Service rating appears to be 24 or so, out of 30. On the other hand, there is cause for concern about a higher price point for restaurants with excellent service: the two restaurants with the highest service ratings (about 24) do not have the highest average dinner prices: one is priced around $54 with ten or so restaurants charging more for dinner, with lesser service ratings; and the other prices dinner quite modestly at under $40. Indeed, restaurants with more modest service ratings of 18 and 20 are among the most costly in the survey. Based on this analysis, it does not seem worthwhile to rest higher Prices exclusively on high Service ratings.

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[2]Obviously much more could be done, e.g. even a simple multiple regression analysis would be helpful here, since we could also examine how ratings work in combination to affect pricing. For illustrating the IMRAD paper however, this is enough.

Table 1: Raw data record for the restaurant Nello.

Restaurant	Price	Food	Decor	Service	East
Nello	54	18	16	15	1

Interestingly, the two restaurants with modest Service ratings and maximal dinner Prices also have quite modest Food ratings, as can be seen from top row of scatter plots in Figure 1. Examining the raw data[3] in R, we find is located East of Fifth, and the other West of Fifth, so location does not appaer to be a direct influence. Instead, these restaurants seem to be getting a boost from relatively high Décor ratings.

Turning to the boxplots in Figure 2, it appears that there is some influence of location (East of Fifth Avenue, vs West); the median price goes from about \$40 to about \$45, with a similar shift in the lower and upper quartiles of price. However, the interquartile range is about \$10 or so, and the entire range of prices for restaurants East of Fifth Avenue completely contains the range of prices for those West of Fifth. Since the typical effect of location is similar to the effect of a one-point increase in Food or Service rating—about \$5—it may not be worth it to choose a location East of Fifth, especially if the price of rent and other operating costs are substantially higher East of Fifth.

There do not appear to be any strong outliers in Price in this data set. The boxplots in Figure 2 do not show any outliers by the usual $1.5 \times$ IQR rule, and the scatterplots in the top row of Figure 1 generally confirm this. One restaurant seems to have a relatively high dinner Price, about \$54, with rather low Service and Food ratings (15 and 18, respectively). Examining the raw data[4] in R, the restaurant appears to be Nello. From the raw data record shown in Table 1, we see that the Decor rating is also a modest 16, but the restaurant is located East of Fifth.

4 Discussion

The many Italian restaurants north of Flatiron in Manhattan surveyed by Zagat (2001) exhibit a wide range of Price as well as Food, Décor and Service ratings. In our exploratory analysis, we found that Food and Service ratings exert high and nearly identical influence on Price, with an increase of one rating point associated with about a \$4–\$5 increase in average dinner price, while Decor has an effect about half as large. Overall, location (east or west of Fifth Avenue) does not appear to have an unambiguous effect, though we found one restaurant—Nello—whose price seemed unusually high for its otherwise modest ciustomer ratings, located east of Fifth Avenue.

There is scope for establishing a restaurant with higher Service ratings than any others in the Zagat surveys; indeed, ratings on all three scales top out at about 24 or 25 out of 30. However, a high Service rating does not seem to be necessary nor sufficient to command a high dinner Price.

This analysis was based on univariate and bivariate exploratory analyses, and as such could not readily consider the interaction of two or more variables influencing price. In addition, since no statistical model was assumed, no measure of uncertainty could be obtained; thus it is difficult to tell which effects we have estimated and reasoned above are sufficiently larger than variation in the

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[3]We used the R command `nyc[nyc$Price==max(nyc$Price),]`.

[4]We used the R command `nyc[nyc$Service==15,]`, since there appear to be only five restaurants with this Service rating; from there it is easy to identify Nello from the R output...

sample to be considered important for decision making. Future analyses should at least consider multivarate regression, which could in principle address these shortcomings.

Our study was also limited by the use of Zagat (2001) data as reported by Sheather (2007). It is not known how representative this data is of Italian restaurants generally in Mmanhattan; the Zagat data were collected to give Zagat readers useful information about individual restaurants they might be interested in, rather than to provide an unbiased characterization of Italian restaurants in the target area. In addition, the data is somewhat old; the population of Italian restaurants has undoubtedly changed in the past 17–18 years, and prices and ratings have undoubtedly changed as well.

In summary, keeping the caveats of the last two paragraphs in mind, there is scope to establish a restaurant providing "the highest quality Italian food utilizing state-of-the-art décor while setting a new standard for high-quality service in Manhattan" (Sheather, 2009, pp. 5–6). Location (East or West of Fifth Avenue) does not seem to be a big price driver, on average; and there doesn't seem to be much hope of establishing a price premium for outstanding service alone. However, a restaurant with ratings in the 25–30 range on Food, Décor and Service could have an average dinner Price in the $60–$70 or so range, and be competitive within the set of restaurants surveyed by Zagat (2001), for which the highest average dinner price was $65.

References

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