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**EFFECT OF INFORMATION ON  
CONSUMER PERCEPTION: EVIDENCE  
FROM RESTAURANT HYGIENE GRADE  
CARDS IN NEW YORK CITY**

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# **Effect of Information on Consumer Perception: Evidence from Restaurant Hygiene Grade Cards in New York City\***

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September, 2015

## **Abstract**

This study examines the effects of increasing provision of hygiene quality information on consumer assessment of restaurant quality. In July 2010 New York City introduced mandatory hygiene grade cards to be displayed in restaurants. I show that both an A grade and better inspection scores are correlated with higher ratings in food, decor, service and price, with the former having a larger impact. These results suggest that consumers give much credence to the information provided by hygiene grade cards but the underlying scores might not reflect the true hygiene quality of restaurants.

Keywords: consumer assessment, restaurant quality, hygiene quality information, hygiene grade cards

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\* I take this opportunity to express to Abdul Noury, Karl Storchmann and Kevin Thom for the valuable advice and help on this project. I also thank my parents for the unceasing encouragement, support and attention.

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# 1 Introduction

Consumers form opinions about product quality based on two main sources of information: internal information and external information (Solomon [2001]). The latter is composed of several sub-categories, such as advice from friends and relatives, expert opinions, advertisement, travel guides, inspections (Crotts [1999]). Information as such obtained before actual experience induces some expectations which may in turn influence the actual experience afterwards. In the context of restaurant quality assessment, such impact is fairly evident. Consumers normally evaluate a restaurant from several aspects, including food, service, dining environment, hygiene quality and atmosphere. All the factors are to some extent correlated with each other and a defect in one aspect could impact consumer assessment of other ones significantly.

This paper is intended to test such correlation. Specifically, I test whether increased information about restaurant hygiene quality influences consumer evaluation of food, decor and service, and also the price level of a restaurant. I investigate this question by focusing on the restaurants in Manhattan. In July 2010, the New York City government passed a new regulation which requires all the restaurants to prominently display a standard-format letter grade card to reveal hygiene inspection results. Prior to the policy restaurants had been inspected regularly but the results were not publicly available. Under the context of imperfect and asymmetric information with many key elements of a restaurant's operations that influence standards of hygiene being unobservable, consumers will use observable information cues that they consider to be associated with the supply of safe foods (Henson et al [2006]). Most information cues are experience characteristic, that is, they are obtained through actual consumption. The letter grade cards provide increased hygiene quality information which mitigates the information asymmetry between restaurant and consumers. This change opens an authoritative source of advice that provides a pre-consumption information for consumers.

Data on inspection results from Department of Health and Mental Hygiene (DOHMH) include every inspection from July 2010 to September 2014 in New York City but I will focus on Manhattan only. I use Zagat ratings from 2010 to 2014 as a measurement of

consumer assessment of restaurants. Zagat group publishes its guidebook once a year by drawing on online anonymous consumer surveys. It is a widely used and trusted source of consumer restaurant evaluation. Each Zagat guidebook includes ratings for food, decor, service and averaged price for a dinner, which allow tests of influence of increased hygiene quality information on different aspects.

From the inspections restaurants will receive scores and sometimes letter grades based on certain conditions, with only the latter being shown directly to the public. Lower scores are better results. The inspection result data include both the scores and the letters. I examine consumer's response using the two indicators separately. I find that, as expected, the ratings for food, service, decor and price are all higher if a restaurant has an A rating and has a better inspection score. The magnitude of effect for an A grade, however, is greater than that of a better score. There are two possible explanations for this result. First, if the scores reflect truly the hygiene quality, it indicates that in the presence of information asymmetry, consumers are not capable of inferring enough information from observable factors and they give much credence to the information conveyed by the hygiene cards. Second, it could be true that inspectors change their behavior after the policy change which makes the scores less liable as indicators of true hygiene quality. The second situation leads to a further discussion about how to improve the efficacy of the current system.

The rest of the paper is organized as the following. Section 2 provides an overview of the policy change and a discussion of some potential effects it may have on consumer perception. In Section 3 I present my data and in Section 4 I outline the econometric approach and report the results. I continue to test whether the inspection scores are truly exogenous and whether the new policy induces a change in inspector behavior in Section 5. In Section 6 I identify two selection problems that might cause downward biased results. I summarize the main findings and discuss some policy implications in Section 7.

## 2 Policy Change and Potential Effects on Consumer

### Perception

In July 2010, the New York City government passed a policy requiring all restaurants to publicly display a standard-format letter grade card to reveal the hygiene inspection results from Department of Health and Mental Hygiene (DOHMH). Restaurants had been inspected regularly before the policy change but the results were not publicized. The new policy requires the letter grade cards to be displayed prominently in the window or other spots where they could be easily seen.

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In each calendar year there should be at least one inspection but the specific number of inspections conducted depends on the previous inspection results, frequent A-grades leading to fewer inspections. Inspections are conducted in cycles. In the first round of an inspection cycle, the inspector will assign a score for each violation detected based on pre-set regulations and scores are added up to be the final result; the smaller the score, the better the result. If the score is under 13, an A letter grade card will be issued and should be posted immediately. Otherwise, the restaurants will not receive a letter grade and will be re-inspected normally within a month without any notice in advance. During the re-inspection the restaurant will get a letter grade corresponding to its score with certainty. Specifically, a score under 13 corresponds to an A; a score from 13 to 18 means a B grade; anything above 28 is C or a shut-down if critical violations are detected. Once a letter grade is given out, the results will be put on record.

The new policy increases the provision of information to consumers which I expect to affect consumer's behavior in several ways. Jin and Leslie (Jin and Leslie [2003]) summarize that in the absence of restaurant hygiene grade cards, restaurants know significantly more about the level of hygiene quality than the customers do. Henson (Henson

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<sup>1</sup>"How We Score and Grade." [Http://www.nyc.gov/html/doh/html/home/home.shtml](http://www.nyc.gov/html/doh/html/home/home.shtml). N.p., n.d. Web. 13 Dec. 2014.

<sup>2</sup>"Requirements for Posting Letter Grade Cards." [Http://www.nyc.gov/html/doh/html/home/home.shtml](http://www.nyc.gov/html/doh/html/home/home.shtml). N.p., n.d. Web. 13 Dec. 2014.

<sup>3</sup>"What to Expect When You're Inspected: A Guide for Food Service." [Http://www.nyc.gov/html/doh/html/home/home.shtml](http://www.nyc.gov/html/doh/html/home/home.shtml). N.p., n.d. Web. 13 Dec. 2014.

et al [2006]) points out that consumers can infer information about hygiene quality from other observable indicators, including food quality, price of the restaurant, appearance and attitude of staff, type of cuisine, cleanliness of the dining areas and bathroom and etc., but all the information cues are obtained through actual dining experience. Other mechanisms, such as reputation, may assist consumers in making dining decisions (Jin and Leslie [2009]), but the lack of direct information to identify food hygiene leaves the consumers with few options but trying out the restaurant before forming a personal opinion. Disclosure of restaurant hygiene grades mitigates the information asymmetry, allowing consumers to identify hygiene quality differences across restaurant before consumption. In two ways consumer behavior would possibly change accordingly. First, Jin and Leslie (Jin and Leslie [2003]) have identified that customers have more freedom and incentives to switch to restaurants with good hygiene as indicated by the grade cards. The demand at good hygiene restaurants may then increase and create an incentive for all restaurants to improve the hygiene quality in general to increase their competency. Second, pre-experience knowledge could form a pre-set impression which may affect the actual experience-related evaluation on restaurants. The hygiene grades might lead to an expectation which interact with the true dining experience for the consumers to form an evaluation. The second aspect is less examined in the existing literature and the analysis of the effects would give an idea whether the increase in provision of information would influence customer conception which in turn causes an incentive from the demand side for the restaurants to improve their hygiene quality level.

### **3 Data Summary**

Two datasets will be included in the project. Restaurant Inspection Results dataset from DOHMH covers every restaurant inspection from July 2010 to October 2014 in New York City. It assigns a unique code to each restaurant and includes basic information such as the name, address, borough and cuisine type. More importantly, it records inspection date, violation codes, scores and corresponding letter grades if there is one for every inspection

of each restaurant. Given that the focus of the project is on Manhattan area only, I narrow down the data range accordingly. Considering the fact that there are several randomly assigned inspection cycles within a year, in order to identify the letter grade which will be most possibly seen by the consumers, I re-organize the scores and letter grades on a quarterly basis. Fortunately, after the further organization there is at maximum one inspection with only a score and one inspection with both a score and a letter grade for each restaurant. For any quarter which has no record of inspections, I assume that the restaurant will not undergo dramatic change in hygiene quality within one quarter and I copy the score and the letter grade from the previous one, except for quarter 3 of October since it is the very first quarter since the start of the policy. A preliminary analysis shows that the scores given out during the period indicate a change in inspector behaviors. Jin and Leslie (Jin and Leslie [2003]) show that a change in the shape of the distribution of inspection scores occurs after the introduction of hygiene grade cards from their data. When there are no grade cards, the distribution is very smooth. With grade cards a dramatic spike appears right before the threshold. Although my dataset does not have inspection scores before the policy, the data in 2010 could be reasonably considered as the reference point since during the initial stage people might be slow in understanding the implication and changing their behavior accordingly. With this assumption, the data give out the same graph as in the Jin and Leslie (Jin and Leslie [2003]) paper. This analysis will be discussed in more details later in Section 5.

Zagat surveys from 2010 to 2014 are used to measure consumer evaluation of restaurants. The Zagat group conducts annual online surveys on reviews of restaurants from around 40,000 anonymous and regular diners. Each participant separately rates the food, decor and service on a 0-3 point scale (0 = fair/poor, 1 = good, 2 = very good, 3 = excellent). These ratings are averaged and presented on Zagat's 30-point scale later on (0-9 = poor to fair, 10-15 = fair to good, 16-19 = good to very good, 20-25 = very good to excellent, 26-30 = extraordinary to perfection). The surveyors use the price of a dinner with one drink and tip as the benchmark estimate for price ratings. Diners are also asked to share comments about their experiences, which the editors curate into concise



reviews. All the ratings and reviews, along with basic information, such as name, address, telephone number and cuisine type of more than 2000 restaurants, are published annually at the beginning of October as a guidebook. The book is labeled as one year after the publish date. For example, the one published in October, 2010 is named as Zagat 2011. I keep the restaurant with data for at least two years, which leads to a final number of 1262 restaurants each year.

For the major analysis of the effects of inspection results on consumer assessment of the restaurant, the Inspection Results dataset is narrowed further to match with the Zagat restaurants. Since the Zagat guidebook is published at the beginning of the last quarter of each year, the inspection results which would possibly influence the Zagat ratings are from the last quarter of the previous year and the first three quarters of the publishing year. In order to minimize the problem of collinearity and to maintain the best information, only quarter three scores and letter grades will be used as indicators of the results in the main regression.

## **4 Effects of Hygiene Letter Grades on Consumer Perception**

Restaurants offer products which could be evaluated from various aspects, including food quality, service quality, decoration, hygiene quality and etc.. The hygiene grade cards provide a direct and authoritative source of information to consumers about the hygiene quality of the restaurants. Pre-experience as such may influence consumer evaluation of other factors. In this section, I examine whether the grade cards cause a change in consumer perception. Specifically, I examine 1) whether A-rated restaurants have higher ratings compared to non-A places, controlling all other variables and 2) whether ratings are correlated with the numerical inspection scores. In this section I assume that the inspections scores are an accurate and standardized measurement of restaurant hygiene quality. Therefore, the scores are a good proxy for the information that the consumers could easily infer even without the hygiene grade cards. The second test, therefore, is

essentially testing whether the Zagat ratings are affected by the hygiene quality of the restaurants. Indeed, as noted in Section 3, there is possibility that the grade card policy has induced a change in inspector behavior which would make the inspection scores a biased measure of hygiene quality. This issue will be addressed separately in Section 5. The estimating equation is

$$R_{it} = \alpha_{it} + \beta Hygiene_{it} + \gamma_1 low_{it} + \gamma_2 pm11_{it} + \gamma_3 sunday_{it} + \gamma_4 monday_{it} + \gamma_5 nocred_{it} + zipcode_i + cuisine_i + s_{it} \quad (1)$$

where  $R_{it}$ , in different equations respectively, denotes the Zagat ratings for food, decor, service and average price for restaurant  $i$  at time  $t$ . Hygiene has two specifications: a dummy letter grade which equals one if a restaurant has a grade of A at time  $t$  and equals to zero if not, and the numerical scores of inspections. Dummy variables, including whether a restaurant has only a few reviews from diners, whether it opens after 11 pm, whether it is closed on Sunday or Monday and whether it accepts credit cards (nocred equals to one if a restaurant does not accept credit cards), are used to capture other unobserved features. Zip codes and cuisine codes fixed effects are included to control the location and types of food served. The  $\alpha, \beta, \gamma$  are coefficients to be estimated.

In the regressions, the dependent variable is a restaurant inspection result, both the letter grade and the numerical score. Identification of the effects from inspections is the time series variation in the Zagat ratings. Zip codes and cuisine fixed effects are selectively included to compare whether time-invariant restaurant and neighborhood characteristics have effects on the ratings. Studentized residuals outside the  $\pm 3$  range are excluded.

Table 1: Effects of Hygiene Grades on All Zagat Ratings

Variables	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Food	Decor	Service	Log(price)	Food	Decor	Service	Log(Price)
Hygiene Letter Grade (A)	0.251** (0.0918)	0.538** (0.151)	0.403** (0.0931)	0.0405** (0.0158)				
Hygiene Score					-0.0159*** (0.00464)	-0.0229** (0.00995)	-0.0191*** (0.00576)	-0.00147 (0.000938)
R <sup>2</sup>	0.307	0.261	0.143	0.083	0.309	0.263	0.143	0.083
Cuisine FE	YES	YES	YES	YES	YES	YES	YES	YES
Zipcode FE	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses  
 \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

Notes: The regression uses pooled data analysis. Hygiene Letter Grade A is a dummy variable. This table only shows the results of the letter grade and scores. Results including other controlling variables for food, decor, service and price Zagat ratings, respectively, are presented in the appendix in separate tables.

Table 1 reports the results from all OLS estimation of equation (1) for hygiene specifications and the full reports on other variables could be found in Appendix. All coefficients, for both the letter grade and numerical score, are highly significant when cuisine and zip code fixed effects are included. The estimated effect from a grade A is an increase of 0.25, 0.54 and 0.40 points, respectively, for food, decor and service. The estimated increase in price is 4.05 %. The positive and significant estimates are evidence in favor of the expectation that increased and direct information influence consumer perception. In particular, the magnitude of the estimates is greater for decor and service compared with food quality. This result supports the belief that people associate hygiene quality information more with observable indicators such as the dining environment and the appearance and attitude of the staffs. The assessment of food quality possibly depends more on the food per se as long as no apparent signs of poor hygiene, such as bugs or dirty plates, are spotted. Additionally, an A-rated place is more likely to afford to charge more on average. The inclusion of region and cuisine fixed effects reduces the bias.

The results with the numerical inspection scores are also all highly significant. The estimated average decreases on average in food, decor and service are 0.016, 0.023 and 0.020 points, respectively. The price on average also decreases by 0.147 %. The negative correlations prove the idea that poor hygiene causes consumers to give lower ratings and

such restaurants on average charge less. The magnitude of these coefficients, however, suggests that the correlation between the scores and the ratings is fairly weak, especially compared with that of letter grades. On the one hand, if the assumption that the scores are an accurate measurement of restaurant hygiene quality still holds, the result indicates that consumers could not infer enough information from the observable indicators and the increased information provided by the hygiene grade cards, therefore, is believed by the consumers as a trustworthy source and serves as a guide for their assessment. On the other hand, if the assumption is loosened, it could be possible that inspectors do not give out standardized and fair scores which make these scores a poor proxy for the true hygiene quality of the restaurants.

The estimates of other restaurant characteristics are also interesting to interpret. These variables are not literal indicators but capture unobservable features of the restaurants. The results show that restaurants that open after 11 pm on average charge more, are better decorated but serve worse food while the ratings for service quality are not statistically significant in terms of Zagat ratings reported. Possible explanations are that restaurants which open until late night usually serve customers such as students, late night workers or clubbers. The need for these people could merely be satisfying the hunger immediately rather than appreciation of food or enjoying the dining atmosphere. Therefore, the quality of the foods is lower on average but the price is higher compared to similar restaurants. Since the expectation for dining environment could be low, the ratings for decoration may be generous. As for restaurants which close on Sundays, Mondays or both, coefficients for all four ratings are significant and positive, especially if one is closed on Sundays. It could be that restaurants that are closed on Sundays tend to be more high-class so that they on average receive higher ratings in all aspects. For places which do not accept credits, the results show that they in general have worse service and decoration, charge less but the food is better. These results are consistent with the fact that most cash-only restaurants in Manhattan are of small scale and serve ethnicity-specific food, such as Chinese, Latin, Indian and etc.. In general, consumers go to these restaurants looking for authenticity of the food rather than high-class dining experience. Thus,

people are willing to pay little money to have the authentic food at a relatively crappy place.

## **5 Are Hygiene Scores Exogenous?**

In the analysis of the effects of inspection results on consumer assessment of the restaurants, I assume that the hygiene inspection scores are exogenous. Nonetheless, this assumption might not hold in reality. Jin and Leslie (Jin and Leslie [2009]) test the hypothesis that reputational incentives are effective at causing restaurants to maintain good hygiene quality when quality is unobservable prior to purchase for consumers. They find that chain affiliation provides some reputational incentives and the degree of repeat customers also affects the strength of reputational incentives for good hygiene in general. They argue that the degree of incentives to maintain good hygiene quality depends on the magnitude of reputation formation related to consumer learning. Specifically, they believe that, prior to the grade card, the degree of consumer learning is greater for chain restaurants than for non-chain restaurants. Since consumers may learn about a chain restaurant's hygiene condition from experience in other restaurants that belong to the same chain, if chain restaurants internalize the externality, better consumer learning implies more repeat business and therefore higher demand. As for the regional specific information mechanism, consumers could learn about a restaurant by repeatedly patronizing the restaurant personally and through exposure to local news and information from friends. All else equal, two restaurants located close to each other face similar consumer learning.

In the specific case of Manhattan, ethnicity clustering may also influence regional consumer learning mechanism. In general, ethnically specific neighborhoods in Manhattan, such as Chinatown, Little Italy, Korean Town and etc., are considered to represent the authentic culture on a minuscule scale. Restaurants in these neighborhoods mostly serve the same type of cuisine. Both the tourists and residents tend to focus more on the authenticity of the foods rather than the dining environment. Moreover, these neighborhoods mostly residential so that people

may build personal connections with the restaurant owners. This situation could lead to less attention to the hygiene quality. These two factors to some extent may produce contradictory effects of Jin and Leslie's expectation, which leaving the effects of regional incentive mechanism ambiguous in the case of Manhattan.

In their paper, Jin and Leslie (Jin and Leslie [2009]) use a basic model to show the presence of reputational incentives by testing whether the difference between the before and after region fixed effects is statistically significant across regions. In this test, they assume: (a) grade cards change the degree of consumer learning but not the other regional factors; and (b) grade cards, as a superior information tool, equalize the degree of consumer learning about restaurant hygiene across all regions. The specifications for inspections conducted before and after grade cards are the following, respectively:

$$S_{ijt}^b = \alpha_j^b + \beta c_i^b + \gamma f_i^b + X_i \theta^b + \varepsilon_{ijt} \quad (2)$$

and

$$S_{ijt}^a = \alpha_j^a + \beta c_i^a + \gamma f_i^a + X_i \theta^a + \varepsilon_{ijt} \quad (3)$$

The dependent variable  $S$  denotes the hygiene inspection scores of restaurant  $i$  in region  $j$ , inspection  $t$ , before the introduction of grade cards.  $\alpha$  is region-specific fixed effects.  $c$  indicates whether  $i$  belongs to a chain.  $f$  shows whether the restaurant is franchised.  $X$  is a vector of all other restaurant observables and the error component contains observed hygiene shocks. The interpretations of the region fixed effects are:

$$\alpha_j^b = a_1 r_j + a_2 w_j + a_3 r_j w_j, \quad (4)$$

and

$$\alpha_j^a = a_1 r_j + a_2 w_j + a_3 r_j w_j. \quad (5)$$

where  $\bar{r}$  is the level of consumer learning associated with the presence of posted hygiene grade cards. In the test, they simply assume that  $a_3 = 0$ , which rules out any interaction effect between information and other regional factors that affect hygiene. Under this assumption, they basically test whether  $(\alpha_j^b - \alpha_j^a)$  is statistically different across regions to test the presence of region specific reputational incentives.

The DOHMH dataset does not include any results before the introduction of the policy but I could reasonably assume that the scores from 2010 could represent the situation without the presence of the hygiene cards. Since the last two quarters of 2010 are the initial stage of the policy, both the restaurant owners and the consumers

might not grasp the implication of the policy and the future influence. Therefore, the reaction stage could be considered as a reference point. Since the dataset only provides the cuisine types and zip codes of the restaurants and most of them are not included in the Zagat guidebooks, the chain affiliation and other observables are not obtainable. Nonetheless, I still want to run a test to see if the difference between scores before and after the policy could be explained by fixed effects of cuisine types and locations. My intuition is that restaurants in ethnicity intense neighborhoods might not change much due to the policy change and some high-end cuisine types, such as French, would respond more actively than Chinese and burger places. I use a simplified version of the Jin and Leslie's specification:

$$S_{ijt}^b = \alpha_j^b + \beta_i^b + \varepsilon_{ijt} \quad (6)$$

and

$$S_{ijt}^a = \alpha_j^a + \beta_i^a + \varepsilon_{ijt} \quad (7)$$

$\alpha$  is the region fixed effect while  $\beta$  is the cuisine fixed effect for restaurant  $i$ . I simply test whether  $(\alpha_j^b - \alpha_j^a)$  and  $(\beta_i^b - \beta_i^a)$  are statistically significant to see whether the scores are influenced by these two factors. For the cuisine type, the reference is African and the zip code reference point is 10001. The regression gives a F-statistic of 1.16 with the P-value of 0.1891. This simple model might need additional specification to become more

convincing. But it is a straightforward attempt to see whether the inspection scores could be explained by other independent variables included in the model.

Another concern about the hygiene scores is whether the introduction of the policy causes a change in inspector behaviors. Jin and Leslie (Jin and Leslie [2003]) present a graph showing that when there are no grade cards, the distribution of the scores is very smooth while a dramatic spike appears after the policy for both mandatory and voluntary disclosure at the score of 90. In their case, scores above 90 correspond to an A letter grade. The graph could be found in Appendix as Figure 3. They offer two plausible explanations for the spike. First, they argue that since there is no differentiation between a low-A and a high-A score from the perspective of consumers, there is no additional benefits thus incentives for a restaurant to improve its hygiene quality beyond the level of a score of 90. Therefore, a spike in the hygiene distribution at 90 is expected. Second, they explain that inspectors may choose to ignore a violation in order to help the restaurants that are merely one or two points below 90. This may give some doubt to the actual improvement of restaurant hygiene.

In the case of Manhattan, the kernel density graph of all the Zagat-included restaurants in the case of Manhattan shows a similar pattern as in Figure 1. Due to the limited number of observations on Zagat-included restaurants in 2010, considered as pre-policy score reference period in the dataset, there is not a smooth line in the graph as the one in Jin and Leslie's graph. For year of 2011 to 2014, however, the spike does appear as expected just below the threshold of 13. Similar patterns from data of different cities add strength to Jin and Leslie's belief that there is a change in inspector behavior due to the introduction of the hygiene grade cards. Johnson, Almanza and Nelson (Johnson, Almanza and Nelson [2014]) show through their surveys that the likelihood of writing down violations was influenced by several factors, including severity of violations, attitude of restaurant managers, previous inspection history, relationship between the manager and the inspector and inspector's perception of the purpose of the inspections. The ultimate purpose of restaurant inspection is to reduce the incidence of foodborne illness and ensure food safety (Filion and Powell, [2009]). The differences of the understanding of the system



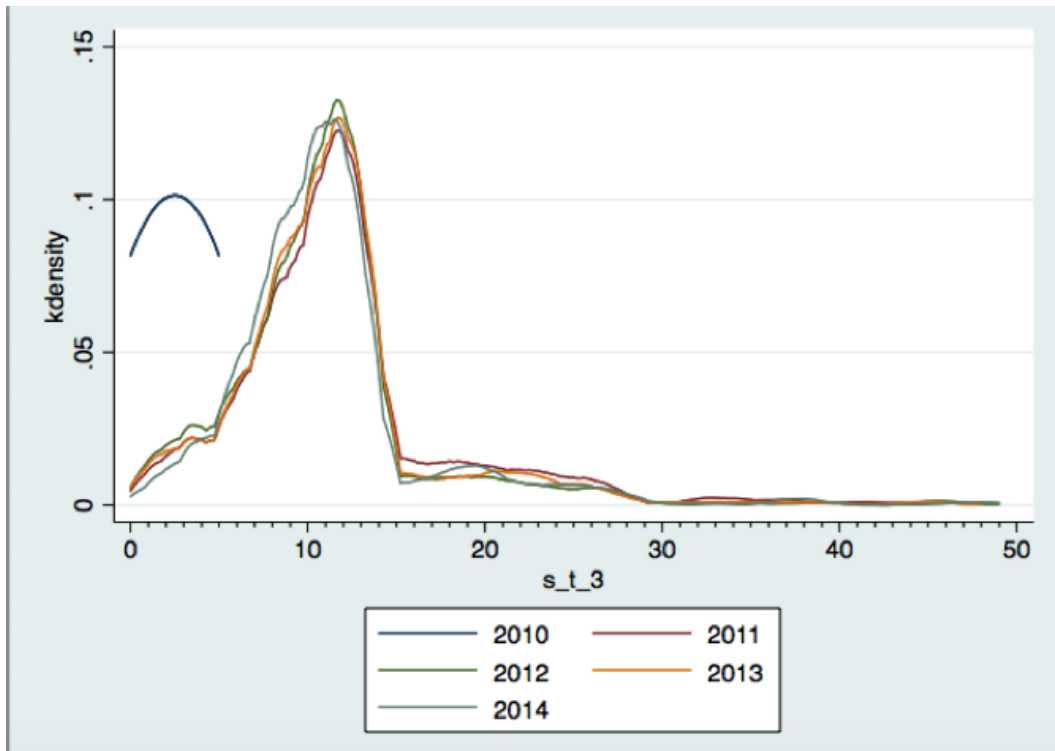


Figure 1: Distribution of Hygiene Scores for Zagat-included Restaurants

and actions of recording of violations among the inspectors could cause confusion in both the education in food safety to the foodservice establishments and the enforcement of the food safety regulations, thus conveying biased information to consumers.

The kernel density graph of all inspections in the inspection result dataset gives additional interesting information as shown in Figure 2. Increased numbers of observations in 2010 in this case lead to the smooth line for pre-policy situation expected by Jin and Leslie with the spike right below the threshold. More interestingly, there are some missing data within the range of 0 to 9 and 14 to 16 after the introduction of the hygiene cards. Intuitively, on the one hand, restaurants with hygiene quality only a little worse than an A-level would invest efforts just enough to get a score around 12 since the lack of differentiation among the A-ratings. This explains the missing data in the range from 14 to 16. On the other hand, restaurants with excellent hygiene might tend to reduce their attention to hygiene management and possibly invest more in other factors such as food quality and decoration to enhance their competency as long as they could get a score

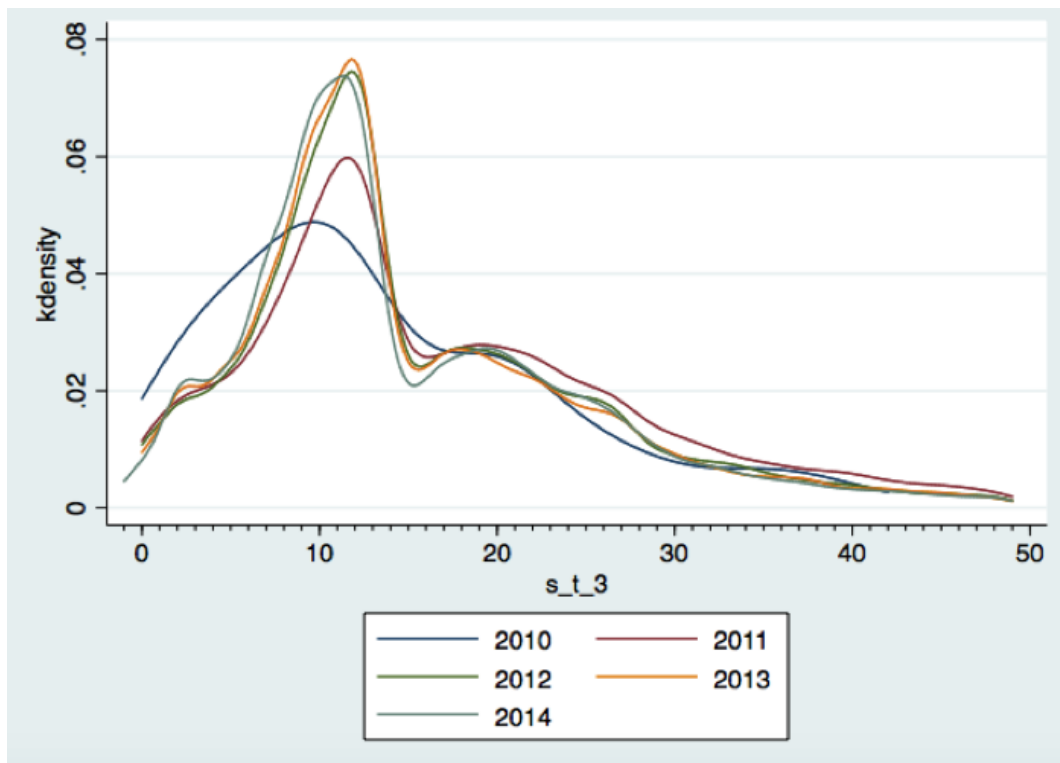


Figure 2: Distribution of Hygiene Scores for All Inspected Restaurants

below 13. As a result, both the good and bad restaurants to some extent converge around the point of 12, contributing more to the formation of the spike.

The results from the previous section show that people do react accordingly to the letter grade and tend to give higher evaluation if a restaurant has an A grade. The positive response creates incentives for restaurants to improve their hygiene quality. Nonetheless, the possible slack-off of restaurants with good hygiene quality shows that letter grades may hide a decrease in efforts to maintain good hygiene from the previously good side. People react to the letter grades because these cards mitigate the information asymmetry and reduce the cost of search to differentiate restaurants without actual experience. The current system obscures the differences within the A-rating ranges and impairs the power of assistance on selection. One alternative is to use the underlying scores of the letter grades. The scores could provide additionally precise information to the consumers to make more informed choices and motivate restaurant to improve their hygiene quality to enhance or at least maintain their competency within the same category of restaurants.

Another possible solution is to introduce subcategories for the A-ratings. For example, in Auckland, New Zealand, a Gold A is assigned to establishments that demonstrate safe practices above full compliance with food hygiene laws in addition to the standard hygiene grades from A to E (Filion and Powell [2009]). Although New York City has a Golden Apple Award as a sign of excellence in food safety, this award is a separate process from the inspections and is totally voluntary and non-participation will not affect a restaurant's legal ability to operate (New York City DOHMH). Since this award is not widely recognized among the consumers, its power of differentiating the excellent ones is limited. Similar initiatives could be added to the ongoing letter grade system to deal with the mentioned problems.

## **6 Discussion of Potential Criticism**

There are two selection problems which are endogenous to the data used and could cause bias to the results. First, by mitigating the information asymmetry, the presence of hygiene grade cards could influence restaurant choice. The focus group survey conducted by Henson shows that 56.4 % of the respondents indicate that they have stopped eating at a restaurant they had previously frequented because of concerns about food safety (Henson et al [2006]). Although the result of the survey might not be conclusive, it matches the intuition that people who are concerned about food safety and interpret an A grade as the only indicator of safe food would refuse to dine at a non-A place. As a result, customers who continue to eat at non-A-rated places might care less about hygiene and their ratings on other aspects might be not influenced by hygiene ratings greatly. Second, restaurants included in the Zagat books are only a fraction of the restaurants in Manhattan. Most of these restaurants are successful in some way so that they have captured attention from the customers. Thus, it might be the case that some restaurants have never paid enough attention to the hygiene quality either before or after the policy but they have developed a loyal group of customers because of the excellent food or atmosphere. In this case, their Zagat ratings might be not influenced by the hygiene quality regardless of the

policy. Both of the selection problems are difficult to deal with due to the limit of the datasets. Nonetheless, since the biases caused by these problems are attenuated effects of the treatment, the significant results from the analyses in the previous sections could only underestimate the effect of hygiene quality and thus still hold regardless of the potential biases.

## 7 Conclusion

This study examines the effects of the introduction of mandatory display of hygiene grade cards on consumer's evaluation of restaurant quality. I analyze a panel dataset for Manhattan including Zagat ratings from 2010 to 2014 and inspections since July 2010 till September 2014 for all concerned restaurants. I use OLS estimating models to analyze separately the effects of an A letter grade and numerical inspection scores on Zagat ratings. The major finding is that for A-rated restaurants consumers give higher ratings in all aspects of restaurant quality, specifically including food, service, decor and such restaurants charge more. All the ratings are also statistically negatively correlated with numerical scores since a lower score is a better result according to the rules. Nonetheless, the magnitude of the effects of an A grade is much larger than that of the scores. Two possible explanations are given for this result: 1) assuming that the scores reflect the true hygiene quality, consumers give much credence to the information provided by the hygiene cards; 2) inspection scores are in fact poor proxies for true hygiene quality.

Believing that inspection scores are not exogenous in reality and may be affected by other factors included in the main model, I continue to examine whether the difference of inspections before and after the policy is significant across neighborhoods and cuisines. Treating the starting period of the policy, which are the last two quarters of 2010 as the pre-policy stage, and test the difference of scores between this stage and 2011, I find that the difference is not statistically significant. However, the spiking in the hygiene score distribution with grade cards supports the concern that grade cards induce a change in inspector behaviors and reduce the scores just above the threshold. This result shows

that the scores might be poor proxies for true hygiene quality and this situation may undermine the efficacy of the system in the long term. In particular, missing data after the introduction of the policy leads to a concern that restaurants with excellent hygiene quality may slack off to the extent where they could ensure an A grade. Although some restaurants may invest more efforts to improve their hygiene and achieve an overall positive result, the potential slack-off of some good restaurants goes against the ultimate purpose of the policy and opens a new discussion for further improvement of the system. Additional subcategories in the A-ratings ranges are suggested for improvement. These findings, while not conclusive, give some insight to the impact of the policy and draw attention to some potential problems in the current system.

## 8 References

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## 9 Appendix

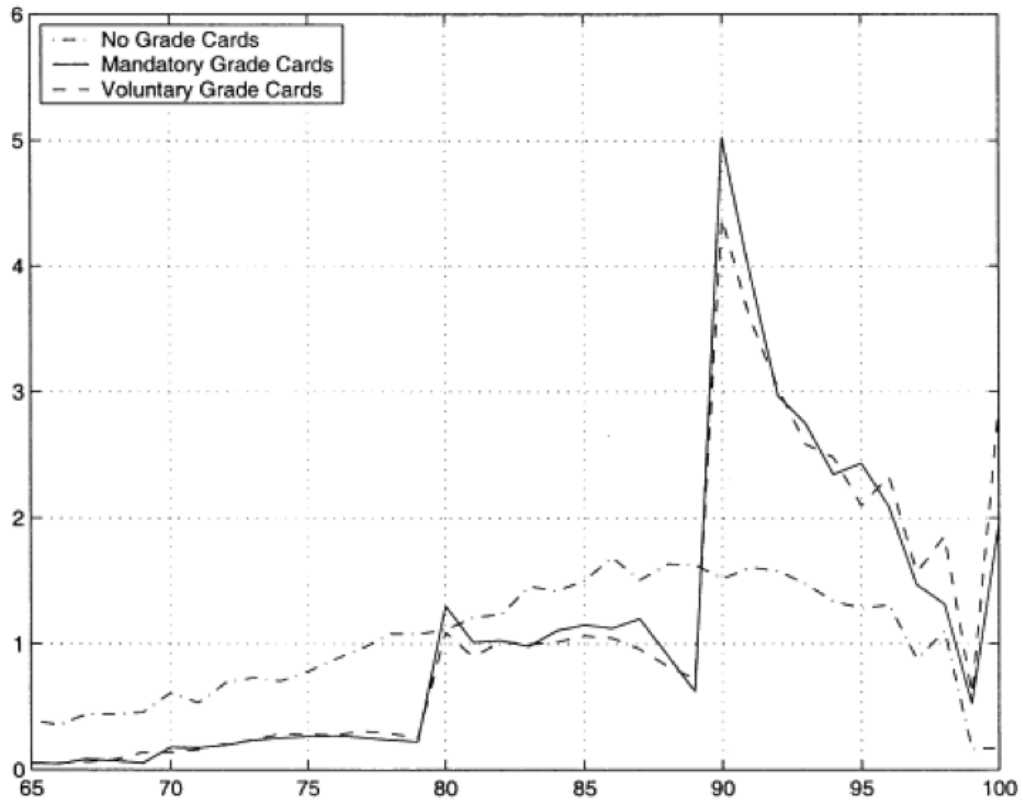


Figure 3: Distribution of Hygiene Scores under Different Disclosure Regimes

Table 2: Effects of Hygiene Grades on Zagat Food Ratings

Variables	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Food	Food	Food	Food	Food	Food	Food	Food
Hygiene Letter Grade A	0.251*** (0.0918)	0.205** (0.0939)	0.232** (0.0932)	0.175* (0.0926)				
Hygiene Score					-0.0159*** (0.00464)	-0.0141*** (0.00454)	-0.0121** (0.00459)	-0.00943** (0.00432)
Open after 11pm	-0.351*** (0.103)	-0.262** (0.117)	-0.185 (0.115)	-0.106 (0.134)	-0.349*** (0.103)	-0.258** (0.117)	-0.181 (0.116)	-0.100 (0.135)
Sunday Closed	1.460*** (0.220)	1.463*** (0.219)	1.982*** (0.236)	2.029*** (0.222)	1.461*** (0.217)	1.467*** (0.217)	1.986*** (0.233)	2.033*** (0.220)
Monday Closed	0.770* (0.398)	1.006** (0.391)	0.918** (0.428)	1.121** (0.477)	0.773* (0.397)	1.013** (0.393)	0.926** (0.429)	1.132** (0.481)
Non-Credit Card	0.683** (0.286)	0.873*** (0.263)	0.424* (0.211)	0.607*** (0.204)	0.697** (0.288)	0.888*** (0.264)	0.418* (0.211)	0.598*** (0.203)
Few reviews	-0.0626 (0.157)	0.0349 (0.141)	0.391** (0.192)	0.524*** (0.181)	-0.0682 (0.158)	0.0308 (0.142)	0.381* (0.194)	0.512*** (0.183)
Constant	20.18*** (0.255)	20.20*** (0.0899)	21.49*** (0.0941)	21.79*** (0.105)	20.53*** (0.285)	20.48*** (0.0471)	21.84*** (0.0558)	22.04*** (0.131)
Observations	3738	3738	3738	3738	3737	3737	3737	3737
$R^2$	0.307	0.261	0.143	0.083	0.309	0.263	0.143	0.083
Cuisine FE	YES	YES	NO	NO	YES	YES	NO	NO
Zipcode FE	YES	NO	YES	NO	YES	NO	YES	NO

Robust standard errors in parentheses

\*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.1

Notes: The regression uses pooled data analysis. The results reflect the effects of a letter grade card on Zagat food rating as well as the correlation between numerical hygiene scores and the ratings.



Table 3: Effects of Hygiene Grades on Zagat Decor Ratings

Variables	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Decor	Decor	Decor	Decor	Decor	Decor	Decor	Decor
Hygiene Letter Grade A	0.538*** 0.538***	0.593*** 0.593***	1.206*** 1.206***	1.231*** 1.231***				
Hygiene Score					-0.0229** (0.00995)	-0.0253*** (0.00924)	-0.0386*** (0.0140)	-0.0406*** (0.0139)
Open after 11pm	0.837*** (0.264)	0.748*** (0.224)	1.187*** (0.279)	1.207*** (0.263)	0.834*** (0.264)	0.748*** (0.224)	1.204*** (0.282)	1.223*** (0.264)
Sunday Closed	1.332** (0.506)	1.677*** (0.508)	2.670*** (0.543)	2.971*** (0.540)	1.295** (0.496)	1.645*** (0.500)	2.651*** (0.534)	2.955*** (0.535)
Monday Closed	0.971 (0.737)	0.777 (0.657)	1.470** (0.708)	1.581** (0.615)	0.991 (0.725)	0.801 (0.643)	1.543** (0.684)	1.658*** (0.589)
Non-Credit Card	-3.489*** (0.549)	-3.634*** (0.522)	-5.570*** (0.931)	-5.667*** (0.913)	-3.464*** (0.539)	-3.611*** (0.513)	-5.631*** (0.924)	-5.733*** (0.910)
Few reviews	-0.183 (0.290)	-0.129 (0.301)	-0.0463 (0.331)	-0.0555 (0.321)	-0.187 (0.291)	-0.135 (0.302)	-0.115 (0.323)	-0.124 (0.313)
Constant	12.99*** (0.345)	13.27*** (0.173)	14.91*** (0.271)	16.04*** (0.280)	13.60*** (0.404)	13.93*** (0.0990)	16.45*** (0.144)	17.54*** (0.228)
Observations	3729	3729	3729	3729	3730	3730	3730	3730
$R^2$	0.506	0.479	0.187	0.152	0.504	0.477	0.181	0.145
Cuisine FE	YES	YES	NO	NO	YES	YES	NO	NO
Zipcode FE	YES	NO	YES	NO	YES	NO	YES	NO

Robust standard errors in parentheses

\*\*\* p &lt; 0.01, \*\* p &lt; 0.05, \* p &lt; 0.1

Notes: The regression uses pooled data analysis. The results reflect the effects of a letter grade card on Zagat decor rating as well as the correlation between numerical hygiene scores and the ratings.

Table 4: Effects of Hygiene Grades on Zagat Service Ratings

Variables	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Service	Service	Service	Service	Service	Service	Service	Service
Hygiene Letter Grade A	0.403*** (0.0931)	0.409*** (0.0937)	0.712*** (0.164)	0.715*** (0.163)				
Hygiene Score					-0.0191*** (0.00576)	-0.0197*** (0.00538)	-0.0249*** (0.00886)	-0.0257*** (0.00884)
Open after 11pm	-0.161 (0.174)	-0.153 (0.153)	0.249 (0.197)	0.308* (0.180)	-0.166 (0.172)	-0.154 (0.152)	0.253 (0.197)	0.313* (0.181)
Sunday Closed	1.777*** (0.317)	1.877*** (0.303)	2.850*** (0.379)	2.978*** (0.348)	1.769*** (0.315)	1.873*** (0.301)	2.856*** (0.377)	2.985*** (0.347)
Monday Closed	1.347*** (0.297)	1.260*** (0.259)	1.730*** (0.239)	1.771*** (0.252)	1.358*** (0.294)	1.282*** (0.257)	1.761*** (0.244)	1.813*** (0.261)
Non-Credit Card	-1.950*** (0.340)	-1.988*** (0.318)	-2.996*** (0.562)	-3.073*** (0.566)	-1.935*** (0.334)	-1.972*** (0.312)	-3.019*** (0.565)	-3.100*** (0.568)
Few reviews	0.411** (0.159)	0.410** (0.158)	0.627*** (0.215)	0.591*** (0.197)	0.405** (0.160)	0.407** (0.158)	0.596*** (0.214)	0.558*** (0.196)
Constant	17.60*** (0.200)	18.06*** (0.129)	17.80*** (0.184)	18.78*** (0.218)	18.08*** (0.249)	18.54*** (0.0577)	18.74*** (0.0777)	19.67*** (0.131)
Observations	3730	3730	3730	3730	3731	3731	3731	3731
$R^2$	0.501	0.479	0.195	0.166	0.499	0.477	0.191	0.161
Cuisine FE	YES	YES	NO	NO	YES	YES	NO	NO
Zipcode FE	YES	NO	YES	NO	YES	NO	YES	NO

Robust standard errors in parentheses

\*\*\* p &lt; 0.01, \*\* p &lt; 0.05, \* p &lt; 0.1

Notes: The regression uses pooled data analysis. The results reflect the effects of a letter grade card on Zagat service rating as well as the correlation between numerical hygiene scores and the ratings.

Table 5: Effects of Hygiene Grades on Zagat Price Ratings

Variables	Specification							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log(Price)	Log(Price)	Log(Price)	Log(Price)	Log(Price)	Log(Price)	Log(Price)	Log(Price)
Hygiene Letter Grade A	0.0405** (0.0158)	0.0448*** (0.0161)	0.0848*** (0.0245)	0.0869*** (0.0230)				
Hygiene Score					-0.00147 (0.000938)	-0.00170* (0.000851)	-0.00229* (0.00127)	-0.00247** (0.00117)
Open after 11pm	0.0618*** (0.0193)	0.0604*** (0.0140)	0.140*** (0.0268)	0.143*** (0.0246)	0.0630*** (0.0196)	0.0613*** (0.0143)	0.142*** (0.0274)	0.145*** (0.0251)
Sunday Closed	0.264*** (0.0345)	0.297*** (0.0314)	0.477*** (0.0424)	0.521*** (0.0364)	0.263*** (0.0342)	0.296*** (0.0312)	0.479*** (0.0423)	0.522*** (0.0365)
Monday Closed	0.0960 (0.0602)	0.0421 (0.0380)	0.194*** (0.0436)	0.151*** (0.0297)	0.0979 (0.0599)	0.0440 (0.0376)	0.199*** (0.0436)	0.156*** (0.0300)
Non-Credit Card	-0.297*** (0.0498)	-0.323*** (0.0475)	-0.560*** (0.0803)	-0.579*** (0.0743)	-0.293*** (0.0479)	-0.320*** (0.0460)	-0.562*** (0.0796)	-0.582*** (0.0742)
Few reviews	-0.00807 (0.0263)	-0.0165 (0.0264)	0.0189 (0.0321)	0.00540 (0.0315)	-0.00806 (0.0264)	-0.0166 (0.0266)	0.0159 (0.0313)	0.00247 (0.0308)
Constant	3.174*** (0.0287)	3.265*** (0.0142)	3.514*** (0.0255)	3.594*** (0.0336)	3.219*** (0.0236)	3.312*** (0.00918)	3.617*** (0.0125)	3.694*** (0.0286)
Observations	3709	3709	3709	3709	3711	3711	3711	3711
R <sup>2</sup>	0.659	0.626	0.242	0.191	0.658	0.624	0.239	0.187
Cuisine FE	YES	YES	NO	NO	YES	YES	NO	NO
Zipcode FE	YES	NO	YES	NO	YES	NO	YES	NO

Robust standard errors in parentheses

\*\*\* p &lt; 0.01, \*\* p &lt; 0.05, \* p &lt; 0.1

Notes: The regression uses pooled data analysis. The results reflect the effects of a letter grade card on Zagat price rating as well as the correlation between numerical hygiene scores and the ratings.