A New Angle on the Effects of a Minimum Wage Increase On Restaurants: Price Pass Through, Quality Changes, and Border Effects

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Abstract

The stagnant federal minimum wage in the U.S. has spurred an unprecedented number of state, county, and citywide minimum wage laws. The high number and varying magnitudes of minimum wage increases combined with the growing online presence of restaurants across the country provides a unique setting in which to analyze the effects of a minimum wage increase on restaurants' prices and quality. Using a novel dataset comprised of menu item and restaurant quality information from thousands of east coast establishments across three states, I estimate the effects of varying levels of minimum wage increases enacted at the start of 2017. I find that prices rise 0.3% - 1.2% in response to a 10% increase in the minimum wage. These price pass through effects are heterogeneous across restaurant characteristics and item type. Further, the magnitude of price pass through is significantly lower for restaurants near the border of a minimum wage policy region, suggesting that local minimum wage policies negatively effect businesses on the borders. Finally, I find that customer perceived quality of restaurants is positively related to increases in the minimum wage for restaurants with high rating levels prior to a minimum wage hike, but negatively related for restaurants with low rating levels prior to a minimum wage hike.

JEL Classifications: J08, J3, H7, H32

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1 Introduction

The minimum wage in the United States has remained stagnant at $7.25 for almost a decade, which is over 30% lower in real terms than the federal minimum wage in 1970. This stagnation of the federal minimum wage has led to a nationwide movement, commonly denoted "The Fight for $15" (Greenhouse, 2016), to increase the minimum wage at a local level. A local law, for this study, is defined as one mandated at the county or city level. In 2012 there were only five local minimum wage laws across the country, but by the beginning of 2017 there were over 40 (UC Berkely Center for Labor Research and Education, 2016). These local minimum wage laws have come with a considerable amount of political debate as there is no clear consensus in the minimum wage literature about the total effects of a minimum wage increase on businesses. The increase and variation in minimum wage policies has opened the door for further research to be done on the effects of such policies.

The main area of interest in this paper is the extent to which a minimum wage increase impacts restaurant prices. The restaurant industry is the primary focus of this minimum wage study due to the fact that nearly three-fifths of all workers paid at or below the minimum wage are employed in the service industry (U.S. Bureau of Labor Statistics, 2016). The price of restaurant food has become an integral part of the American budget. In 2015, for the first time in history, Americans spent more money eating out at restaurants than they did on groceries (United States Department of Agriculture, 2017). And although low income workers receive a higher income after minimum wage hikes, low income workers purchase more minimum wage produced goods (MaCurdy & OBrien-Strain, 2000). This suggests that changes in restaurant prices affect the relative purchasing power of low income workers more than the average customer.

Previous literature has examined effects of a minimum wage extensively, beginning with the publication of Card and Kruger's well known study about the effects of minimum wage changes on the fast food industry in 1994. Card and Kruger found a small positive effect on employment and no effect on prices after an increase in the minimum wage. These findings contradicted the textbook model of competitive labor markets, which predicts an increase in output prices and a decrease in employment. In response to this paper, many studies were published analyzing the existence of monopsony power in the labor market (Manning, 1995; Rebitzer & Taylor, 1995; Burdett & Mortensen, 1998; Bhaskar & To, 1999), as a monopsony model predicts an increase in employment and a decrease in prices. Neumark and Wascher (2006) in their survey of the literature conclude that the most rigorous and reliable studies have found

significant price increases but small employment decreases. As Aaronson, French and MacDonald (2008) conclude, the presence of significant increases in price in response to minimum wage increases is evidence against the prevalence of monopsony power in the labor market. It is therefore expected that an increase in minimum wage will lead to an increase in output prices.

The magnitude of the price pass through to consumers after a 10% increase in minimum wage varies in the literature between 0.4% and 1.5%. The following are specific examples that are most closely related to this paper. Allegrotto and Reich (2015) use full online menus to analyze prices before and after a local minimum wage increase in San Jose and find pass through to be 0.58%. Aaronsen, French and MacDonald (2008) utilize the CPI food away from home data which is comprised of several bundles of food, usually the equivalent of a meal, at a variety of establishments across the country to examine price pass through of state and federal minimum wage changes. The authors estimate a price pass through of 0.7%. Basker and Khan (2013) estimate price pass through at 0.9% for McDonald's Quarter Pounders and a Pizza Hut regular cheese pizza due to state level variation in the minimum wage. These estimates vary with the types of items and time period analyzed but show that restaurants consistently pass through the increased labor costs in the form of higher output prices.

The unique nature of the dataset and policies that I use in this paper allow for more extensive analysis of minimum wage related questions. These additional areas of study include heterogeneity in pass through across restaurant characteristics and item type, changes in restaurant quality, and the existence of border effects. I examine restaurants in three contiguous states on the East coast that all increased their respective minimum wages (though by differing magnitudes) on the first day of 2017. I examine the impact of the minimum wage changes using restaurant menus from Yelp.com and Grubhub.com. Using a longer time period and a larger sample with Yelp.com data, I estimate the impact on prices, customer-perceived quality, and border effects. One potential downside of the Yelp.com data is that restaurant owners may not keep the online menu prices current. To examine this potential concern, I utilize data from Grubhub.com, a website through which consumers directly order, therefore creating an incentive for restaurant owners to keep prices up to date.

Using these data I estimate the overall price pass through at the restaurant level due to a 10% increase in minimum wage to be between 0.3% and 1.2%, depending on the subsample analyzed. These estimates are consistent with previous findings in the literature. The magnitude of the price pass through estimate is heterogeneous across restaurant characteristics, with small and low quality restaurants showing significantly higher pass through. The magnitude of the price pass through also varies at the item level,

where items in categories such as "Popular" and "Sandwich" show a pass through level of over 0.6%, but items in categories such as "Soup/Salad" and "Entre" show significantly lower levels of pass through, with estimates below 0.4%. This is an important indication for studies in the literature that only examine a small number of items on a menu over time.

One way that restaurants could absorb the increase in labor costs, other than by increasing price or decreasing employment, is to decrease quality. For example, changes in overall restaurant quality after a minimum wage hike could come in the form of better service due to efficiency wages, reductions in portion size, or decreases in food quality. This is the first paper that is able to analyze changes in customer-perceived quality due to a change in minimum wage. Using the consumer rated star values from the Yelp review platform, I estimate the impact of a 10% minimum wage increase on the customer rating of restaurants. I find a bimodal effect of an increase in the minimum wage on restaurants. Restaurants that were rated at the mean (3.5) or below prior to the minimum wage increase saw a significant decrease in the star rating given to them by consumers, where restaurants that started at ratings above 3.5 stars saw a positive effect on their consumer ratings due to the increase in minimum wage. The Yelp star rating of a restaurant has been shown to significantly impact a restaurant's profit, thus these estimates are economically significant.

From a policy perspective, one of the proposed negative effects of a minimum wage increase is the inability of restaurants close to the border of the city or state to account for these increased input costs in the form of higher prices without loosing business. It is thought that restaurants facing minimum wage increases close to a border where competitors on the opposite side of the border are not facing an increase in labor costs may have to keep prices artificially low in order to compete. These effects are referred to as border effects, and can be measured by the existence of a significant relationship between the distance a restaurant is to a bordering area with a different minimum wage increase and the magnitude of the price increase. The existence of border effects are crucial when it comes to policy evaluation and fully understanding how local businesses are affected by changes in minimum wage policy. This paper provides the most comprehensive analysis on the existence of border effects to date in the literature. For restaurants located within twelve minutes of a bordering area that is facing a lower minimum wage hike, I find a significant relationship between the restaurant's proximity to the border and the level of price pass through. Specifically, I estimate that a restaurant ten minutes further away from the border increases prices by 0.2 percentage points more than a restaurant on the border. These border effects suggest that a local minimum wage increase impedes the ability of restaurants to fully pass through prices to consumers

due to the spacial proximity to competitors who are not facing an increase in minimum wage.

2   Minimum Wage Laws

On January 1, 2017, three contiguous states on the east coast increased their minimum wage at differing magnitudes, with a variety of levels of increases within the state of New York. Table 1 reports the increases in minimum wage in these areas, which range from 0.72% to 22.22%[1]. These states provide a useful setting for minimum wage analysis as they are in the same geographic region and have similar economic, demographic, and political characteristics. Each area also faced the changes in minimum wage over the same time period.

In April of 2016, New York (NY) became the second state, after California, to pass a law that would incrementally raise the minimum wage for all workers to $15/hour.[2] In this law, which applies to all non-fast food restaurants, the degree of the minimum wage increase is based on the type and location of the establishment (2015-2016 Legislative Session, 2016). The first two rows of Table 1 report minimum wage changes for restaurants in New York City (NYC). Restaurants in NYC with more ten employees, denoted as large restaurants, saw a 22.22% increase. Small restaurants in NYC saw an increase of 16.67%. The third column of Table 1 includes restaurants of all sizes in the three contiguous counties outside of NYC: Nassau, Suffolk, and Westchester. These three counties will be referred to throughout this paper as NYC MSA. These restaurants faced an increase of 11.11%. The final NY group, NY Upstate, includes restaurants of all sizes elsewhere in the state of NY who had a 7.78% increase in minimum wage.

Two of the states contiguous to NY saw changes in their own state-wide minimum wage laws as of January 1, 2017. In 2014, Massachusetts (MA) passed a bill that increased the minimum wage by $1 a year starting at the beginning of 2015. The state saw the final increase relating to this bill on January 1 of 2017, which increased the minimum wage by 10.00% (State of Massachusetts General Assembly, 2014). In the spring of 2016, New Jersey (NJ) proposed a minimum wage law similar to that of NY that would put the state on track to a $15 minimum wage. The bill passed through the house and the senate, but in September of 2016, NJ governor Chris Christie vetoed the bill, stating "...[this bill] fails to consider the capacity of businesses, especially small businesses, to absorb the substantially increased labor costs

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[1]   The last three columns of Table 1 report any changes in the tipped minimum wage. Although there was a change in the tipped minimum wage in Massachusetts, I focus only changes in the regular minimum wage for the analysis in this paper.

[2]   In 2015, NY passed a minimum wage law only applicable to fast food restaurants, increasing the minimum wage each year for fast food workers (New York State Department of Labor, 2015). Do to the small sample size and unique nature of fast food restaurants in the data, I exclude all fast food restaurants from the analysis.

it will impose"(Christie, 2016). Thus in 2017 NJ increased the state minimum wage by only 0.72%, a yearly adjustment for inflation (State of New Jersey Department of Labor and Workforce Development, 2014). The state of NJ is therefore a strong counterfactual to NY and MA due to the similar political sentiment shown by the attempts at increasing the minimum wage.

3   Data

Three primary datasets will be used in this analysis. The first, and most extensive, is a panel dataset comprised of restaurant menu and quality information from Yelp.com. The second is a supplementary panel dataset also comprised of restaurant menu information from Grubhub.com. The third is a dataset providing detailed restaurant business information from ReferenceUSA. These datasets will be utilized to determine the magnitude of price pass through to consumers, how this pass-through varies by restaurant and item specific characteristics, and how the minimum wage affected customer perceived quality.

3.1   Yelp

Yelp.com is a website in which consumers can find restaurant information including customer reviews, hours of operation, price range, and full menus. Yelp was founded in 2004, and currently has an average of 72 million monthly visitors with over 115 million reviews written (*An Introduction to Yelp Metrics*, 2016). The first wave of Yelp data collection was in April 2016, the second wave in July 2016, and the third wave in October 2016. Two waves of data collection occurred after the minimum wage increases, in January 2017 and April 2017.

To collect a geographically representative sample, a list comprised of areas of interest was compiled spanning all three states and focusing more heavily on larger cities.[3] I wrote a webscraping program that iterated through each area of interest, collecting the home page and menu page for each restaurant in the area. The Yelp homepage of each restaurant contains information about the restaurant including address, phone number, Yelp star rating, price range, food category and hours of operation. Approximately one third of these restaurants provide a full menu on Yelp. Some restaurants provide an external link to a menu, but since these menus are not formatted uniformly, the menu information cannot be correctly parsed and thus for the sake of this dataset these restaurants fall into the same category of those restaurants who do not provide an online menu. In a similar study using online menus, Allegrotto (2016)

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[3]   See the data appendix for further details about the data collection process.

also found that on average about one third of restaurants posted full online menus. These externally formatted menus were hand entered for one round of the scrape, and baseline characteristics of these restaurants were not statistically different than the Yelp formatted menus.[4] I assume that there is no relationship between a restaurant's decision to post a full Yelp menu and the minimum wage group to which it belongs. Since each Yelp menu is uniformly written, I created a second program that parsed the item and price information into a usable dataset along with other restaurant characteristics. Figure 1 shows the geographical distribution of the restaurants in the sample.

One concern with using Yelp data is the reliability and frequency with which the information for a restaurant is updated, as Yelp menus may be updated at the restaurant owner or manager's discretion. As a way to deal with this reliability issue, I take advantage of a food delivery service that is powered by Yelp, called Eat24. This service provides customers the ability to order food directly from the restaurant's Yelp menu page for delivery or pickup. The use of this service ensures that the menu items and prices are up to date since customers are ordering directly from the provided menu information. Each restaurant in the dataset has an indicator for whether or not the business utilizes the Eat24 food delivery service.

Yelp users provide online reviews of restaurants and assign them an overall star rating on a scale of 1 to 5, with 1 representing extremely poor and 5 representing outstanding. Although the number of stars that a restaurant has earned is determined by self-selected reviewers, the Yelp star rating has been found to be a reliable predictor of actual quality as well as an important determinant of profit for restaurants. In a study comparing Yelp star ratings of hospitals to an industry standard assessment of quality, Bardach *et al.* (2014) found that Yelp stars were significantly related to patient care and health outcomes. Luca (2011) used a regression-discontinuity design to analyze the impact of a change in the Yelp star rating on restaurants, and found that a one-star increase in the Yelp rating led to a 5-9% increase in revenue. Another concern of using Yelp stars as a point of analysis regards restaurants writing fake reviews– good reviews of themselves and bad reviews of competitors. Yelp uses a proprietary algorithm in an attempt to filter out fake reviews which are in turn not included in the Yelp star rating. Although some fake reviews may still exist, I will assume for the analysis that the any fake reviews on quality are not correlated with changes in the minimum wage.

The rounded star rating that customers see prominently displayed on each restaurant's homepage is the monthly average of all Yelp reviews rounded to the nearest half star.[5] There is significant variation

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[4]   See the data appendix for the comparison table reporting these baseline characteristics.
[5]   If a restaurant has less than 10 reviews within a month, then the most recent reviews are added until the sample size reaches 10.

in the Yelp star rating for restaurants over the time period of the dataset, an indication that Yelp users are active in reporting the current quality of the establishments. Over 50 percent of restaurants see a change in star rating between any given observation period, and the average change given an increase (decrease) is 0.62 (0.61) stars.

3.2   GrubHub

Founded in 2004, Grubhub.com is the largest online food ordering company in the U.S., providing its 7.7 million customers in over 1,100 cities access to delivery at over 45,000 locations (*Grubhub, About Us*, 2016). This data was collected with the primary intention of validating the primary Yelp data. I collected menu information for all GrubHub restaurants in the areas of interest using a second webscrape in December 2016, January 2017, February 2017, March 2017 and April 2017. Although there are fewer restaurants on Grubhub than there are on Yelp, the GrubHub menu prices, which are necessarily up to date given the nature of the delivery service, provide an idea to what extent the Yelp data is generalizable. All restaurants on Grubhub provide a uniform menu and are therefore included in the dataset of parsed menu information. Grubhub also allows customers to rate the restaurants, but there are significantly fewer reviews given on Grubhub than there are on Yelp. Ratings on Grubhub may also reflect the delivery service and not the restaurant itself. Grubhub restaurants are primarily in the more highly populated areas and therefore sample sizes for the smaller cities are much lower in the Grubhub data.

3.3   ReferenceUSA

ReferenceUSA (RUSA), an Infogroup company that provides business data, is used to define more detailed characteristics of the restaurants. I collect the data for all businesses in the areas of interest that are categorized under the North American Industry Classification System (NAICS) as a restaurant. The restaurant level variables obtained from this dataset include sales volume, number of employees, limited service status, and franchise status. Since these data are updated on a yearly basis, the variables are used only as baseline characteristics of the establishments.

3.4   Data Construction and Definitions

To determine the minimum wage that the restaurants face, each restaurant sample is mapped to a county using the Census Geocoder. In NYC, the minimum wage that a restaurant faces is also dependent on the restaurant type. The variables in the RUSA dataset provide enough information to determine these

classifications but restrict the sample size due to limited matching between RUSA and the web scraped datasets. Only a little more than half of the total restaurants in Yelp and Grubhub are able to be matched with the RUSA dataset. This matching problem is consistent over multiple matching methods. Therefore, in this study I use the average minimum wage increase in NYC for all restaurants, regardless of size.[6] Since there are significantly more restaurants that qualify as "small" in NYC, using the un-weighted average of the minimum wage increase will only bias my estimates towards zero.

For the Yelp and Grubhub menu data I create a balanced panel at the item level, only including restaurants and items that are in all waves of data collection. One concern with using a balanced panel is that firms could respond to changes in the minimum wage by changing the items offered. However, I find no significant relationship between changes in the total number of items offered at a restaurant and changes in minimum wage. Another concern is that firms may change the quality of the items in the balanced sample. These potential quality changes are addressed in Section 5.

Summary statistics of the balanced panels aggregated at the restaurant level for Yelp and Grubhub are reported in Table 2 and Table 3, respectively. Limited service and franchise restaurants are a very small portion of the restaurants in both data sets. Most previous studies in the literature have focused primarily on limited service and franchise restaurants, thus these data provide information on an under-represented sub population. It has also been shown in previous studies that limited service restaurants have a higher level of pass through because they employ more workers at a binding minimum wage. This indicates that my estimates may be biased towards zero compared to the pass through occurring in the entire population of restaurants. From these two tables it can also be seen that restaurants update menus less frequently in the Yelp dataset than the Grubhub dataset, but that the changes in price conditional on an increase or decrease are larger in the Yelp dataset.

The three areas used to analyze the existence of border effects are NYC, NYC MSA and NJ. Figure 3 displays a closer view of the geographical distribution of the restaurants in these groups. I first construct a distance matrix using Google Maps Distance Matrix Application Programming Interface. This service provides travel distance and time for a given origin and destination based on the recommended driving route. I calculate a distance matrix for each restaurant in the sample, which is comprised of driving time to all restaurants on the opposite side of a border facing a different minimum wage increase. The minimum of these driving times is then recorded for analysis as the distance to a given border. This provides a finer measure of distance than raw miles. For the border effects analysis, all restaurants that

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[6] The overall results are similar when relying only on matched RUSA data and using the specific minimum wage increase by restaurant type in NYC.

are within 12 minutes of a minimum wage policy border are included, as Iacono et al. (2008) found that 90% of Americans will only travel 12 minutes at maximum to go to a restaurant.

4 Price Pass-Through

4.1 Analytical Model

The first question to answer in this setting is to what extent the increases in minimum wage are passed on to consumers through prices. The base model of price pass through at the restaurant level regresses the log change in price on the log change in the minimum wage,

$$\Delta \ln p_{jkt} = \sum_{h=l}^{L} \beta_h \Delta \ln mw_{kt-h} + \gamma P\_START_j + \zeta T\_BTWN_{jkt} + \epsilon_k + \epsilon_m + \epsilon_{jkt} \tag{1}$$

where p_{jkt} is the average price of items at restaurant j in minimum wage group k in observation wave t.[7] I allow for a flexible price response from restaurants by including contemporaneous and lagged changes in minimum wage. For the specifications using the Yelp data, one lead period is also included ($l = -1, L = 1$) in order to analyze the existence of any relationship between price increase and minimum wage group before the policy implementation.[8] Although all groups knew of the policy changes by April 2016, it is unlikely that restaurants responded to the impending wage hikes more than four months in advance. For example, Aaronson et al. (2008) found that restaurants do not respond to changes in the minimum wage more than two months ahead of implementation. Therefore the estimates of this lead term are a good indication of the existence of potential policy endogeneity. For the Grubhub specification, no lead and three lag periods are included ($l = 0, L = 3$). No lead period can be included since the first period of observation is in December. Although there are three lags included in the Grubhub specification, these time periods encapsulate price changes over the same four month period as the one period lag in the Yelp specification.

The average price at a restaurant before the change in minimum wage is the primary means in which to characterize restaurants in the datasets. Thus P_START_j is the average price at restaurant j in the first observation period.[9] Since the data was collected using a web scrape, there was some variability in the timing of data collection for each restaurant in each wave. The variable T_BTWN_{jkt} is an integer representing the number of days between observations for a given restaurant, and ϵ_m is a

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[7]   Each restaurant is location specific.

[8]   Including a second lead period does not change the results and estimates are insignificant.

[9]   Although estimates for γ are significant, including P_START_j does not significantly change the coefficients of interest.

fixed effect controlling for the month that the data was collected. Together, these two terms account for any differences in the timing of the data collection between waves as well as any seasonality. To test the extent to which other restaurant characteristics are a driving force of the price pass through, X_j, a vector of RUSA variables. This control vector includes sales volume, employees, limited service status and franchise status, is included in some specifications. The key assumption in this specification is that NJ is an appropriate counterfactual for NY and MA. As discussed in Section 2, NJ is geographically close and socioeconomically similar to both states that did increase the minimum wage. NJ also has a similar political sentiment as the state attempted to increase their own minimum wage at the start of 2017. I therefore assume that there are no other unobserved characteristics that are related to both the minimum wage increase and the increase in price.

4.2 Estimates

The results of the statistical estimation model described above are reported in Table 4. All estimates are reported to be interpreted as the percent change in price due to a 10% increase in the minimum wage over the given time period. Observations are aggregated at the restaurant level, and errors are clustered at the minimum wage group level. The row titled "Total Pass Through" is a linear summation of the estimated coefficients in all relevant time periods. For the specifications using the Yelp data, the total pass through estimates are linear combinations of the October '16 to January '17 and the January '17 to April '17 estimates. Since the July '16 to October '16 estimate is only included in the model as a means of testing for policy endogeneity, this coefficient is not included in the total pass through. It is also insignificant in all specifications. For the specifications using the Grubhub data, all time periods are included in the total pass through estimates.

Column 1 reports estimates using the full Yelp sample of restaurants. There was significant pass through in both the contemporaneous and lagged time periods, for a combined pass through estimate of 0.33%. Column 2 includes the vector of control variables from the RUSA dataset. These estimates are almost identical to the estimates reported with the full sample. Column 3 restricts the full Yelp sample to only those restaurants who changed the price of at least one item throughout the course of the dataset. The total pass through estimate for this subsample is significantly larger at 1.22%. The fourth column is restricted to restaurants that employ the Eat24 food delivery service. This price pass through estimate, 0.60%, is also higher than the full sample estimate but not significantly so. The last two columns of Table 4 report estimates using the Grubhub dataset. The estimated pass through using

the full Grubhbub dataset, as shown in column 5 is 0.91%. Column 6 reports that adding the control vector of RUSA restaurant characteristics significantly increases the pass through estimates.

To investigate heterogeneity of price pass through across restaurant characteristics, Table 5 reports the pass through estimates by highest and lowest quartiles of sales volume, employees, and star rating. All columns use the Yelp data and the baseline specification. Once again, no significant pass through is reported from July to October, and the total pass through estimates are linear combinations of the relevant coefficients. Columns 1 and 2 compare restaurants by highest and lowest quartiles of sales volume. Although the high sales volume estimate is larger at 0.33%, it is not significantly different from the pass through estimate of low sales restaurants, 0.19%. Columns 3 and 4 compare restaurants by the number of employees. The pass through estimate of 1.01% for small restaurants is significantly higher than the estimate of 0.32% for large restaurants. Columns 5 and 6 compare restaurants by Yelp star rating in April 2016, before any minimum wage changes. The estimated price pass through for low star restaurants, 0.35%, is significantly higher than the estimate for high star restaurants, 0.17%.

There may also be heterogeneity across item type, and given the nature of the dataset these differences can be explored. Table 6 reports pass through results at the item level using the Grubhub dataset.[10] The baseline specification of model (1) is used, except now an observation is an item. Items in the "popular" category are classified as such based on the frequency an item is ordered through Grubhub. Column 1 reports pass through estimates at the item level for all items, with a total pass through estimate of 0.48%. The subsequent columns report pass through estimates for the seven most frequent item categories.[11] Price pass through for "popular" items, "side" items, and "sandwiches" was significantly higher than the average of all items, ranging from 0.62-0.69%. Price pass through for "soups", "salads" and "entres" were significantly lower than the average of all items, ranging from 0.33-0.37%. Estimates for "drinks" and "desserts" were not significantly different than when using all food categories.

5 Quality Changes

5.1 Model

I now turn turn to the change in customer perceived quality as an outcome variable. Figure 2 depicts the relationship between change in star rating and minimum wage group by the initial star rating of the

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[10] Similar patterns exist in the Yelp dataset, but item categories are not as clear cut and so significantly more items fall into the "other" category. Yelp menus also do not provide a "popular" category.

[11] The categories not reported include; "appetizers", "pizza", "kids", "breakfast", and "other".

restaurant in April 2016, prior to any minimum wage changes. As can be seen from the figure, there appears to be a negative relationship between customer perceived quality and minimum wage for those restaurants who started at a lower rating and a positive relationship for the higher rated restaurants. To investigate this relationship further, the following model is used to analyze the effect of a minimum wage increase on the Yelp star rating of a restaurant j in minimum wage group k at observation wave t:

$$\Delta \ln(stars_{jkt}) = \alpha + \sum_{h=l}^{L} \beta_h \Delta \ln mw_{kt-h} + \gamma P\_START_j + \epsilon_k + \epsilon_t + \epsilon_{ijkt} \tag{2}$$

The variable $stars_{jkt}$ is the rounded half star rating of each establishment. Just as in the previous model, contemporaneous and lag terms for changes in the minimum wage are included to allow for a flexible response. A lead term is also included ($l = -1, L = 1$) since the Yelp data is used, as a check for any pre-policy change relationships between minimum wage group and changes in quality. The term P_START_j, the average price at an individual restaurant in April 2016, is included as a control. The average price of items at a restaurant may provide the customer with an expectation of what the level of quality should be. These ex ante ideas of quality level could have an impact on changes in customer perceived quality. Fixed effects for observation time period and minimum wage group are included in all specifications.[12] I assume that there are no other unobserved characteristics of restaurants that influence both the minimum wage group that a restaurant belongs to and the customer perceived level of quality.

5.2   Estimates

The results of this statistical estimation model are presented in Table 7. All estimates are interpreted as the percent change in star rating due to a 10% increase in minimum wage. The total percent change in star rating is a linear summation of the estimated coefficients from October '16 to January '17 and January '17 to April '17. Once again, the estimate from July '16 to October '17 is not included in the total change since it is only included in the model as a test of pre-trend relationships. The first two columns of the table report estimates using the full sample of Yelp restaurants. Although the estimates are negative, all are imprecisely measured. Column 3 reports the estimated change in star rating due to a minimum wage increase for restaurants that had a 2.5 rating in April '16.[13] The estimated relationship is more negative than the full sample, but once again imprecisely estimated. The next column, 3, report the estimated relationship for restaurants that started at a 3.0 star rating. For these restaurants, a 10%

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[12]   Using the observation period fixed effects are the same as using month fixed effects in this model since the star ratings for each restaurant are collected in the same month for all restaurants.

[13]   Restaurants below a 2.5 rating and above a 4.5 rating are not analyzed as subsamples given that they are close to the lower and upper bounds, respectively, and so only have one direction to move.

increase in minimum wage is associated with a 3.1% decrease in star rating. Column 4 reports estimates for restaurants that began with a 3.5 star rating, the average in the sample. The estimated relationship for these restaurants is -1.1%. As seen in columns 5 and 6, the estimated relationship for restaurants that started at a 4.0 or 4.5 star rating is significantly positive. Restaurants starting at a 4.0 rating saw a 2.4% increase in star rating due to a 10% increase in the minimum wage, and restaurants starting at a 4.5 rating aw a 1.5% increase in star rating. Controlling for price changes in price does not significantly change any of these estimates, suggesting that these changes in quality are not driven by customer dissatisfaction directed at price increases.

6   Border Effects

6.1   Model

To examine the existence of border effects, I first look at the subset of restaurants located within NYC and restaurants within the contiguous NJ counties that are located within twelve minutes of the NYC-NJ border.[14] Figure 3 provides a closer look at the restaurants in these areas. The specification used to test the existence of border effects is

$$
\begin{aligned}
\Delta \ln(p_{j,Oct16-Apr17}) =& \alpha_0 + \alpha_1 \mathbb{1}(NY=1) \\
& + \alpha_2 D_j + \alpha_3[D_j * \mathbb{1}(NY=1)] + \epsilon_j,
\end{aligned}
\tag{3}
$$

where $\mathbb{1}(NY=1)$ is an indicator function denoting if restaurant j is located in NYC, and D_j is the driving distance in minutes to the closest restaurant on the opposite side of the border. Due to the Hudson River which separates NYC and NJ, the shortest distance between two restaurants on opposite sides of the border is 8 minutes. I therefore normalize the distance for the NYC restaurants to zero as to not count this gap distance twice. I assume that there are no other unobserved variables that are related to both the distance to a border and the change in price.

For a restaurant in NYC, the equation becomes

$$
\Delta \ln(p_{j,Oct16-Apr17}) = (\alpha_0 + \alpha_1) + (\alpha_2 + \alpha_3)D_j + \epsilon_j.
$$

The coefficient $\alpha_2 + \alpha_3$ describes the relationship between distance to the border and price increase for

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[14]   The results are persistent further out from the border, but smaller in magnitude.

restaurants in NYC close to the NJ border. For a restaurant in NJ, the equation becomes

$$\Delta \ln(p_{j,Oct16-Apr17}) = (\alpha_0) + (\alpha_2)D_j + \epsilon_j.$$

The coefficient α_2 describes the relationship between distance to the border and price increase for restaurants in NJ close to the NYC border. Figure 4 displays a binned scatter plot of the relationship between distance to the NYC-NJ border and price increase.

6.2   Estimates

Table 8 reports the formal statistical results of the border effect models. Columns 1-3 include restaurants in the Yelp dataset. Column 1 shows the estimated relationship between price changes from October '16 to April '17 and the distance to the border for restaurants on the NYC-NJ border. The estimates show that a restaurant 10 minutes further from the border increases prices by 0.11 percentage points more than a restaurant on the border. No significant border effects are reported for NJ restaurants. Column 2 reports this same relationship but for a price change from July '16 to October '16. This estimate is not significant, suggesting that these border effects are not always present. Column 3 explores the existence of within state border effects of restaurants in NYC to the surrounding counties, or NYC MSA. This estimate is smaller and not significant. Columns 4 and 5 report estimates of border effects using the Grubhub dataset. Column 4 reports that restaurants in NYC 10 minutes further from the border increase prices by 0.18 percentage points more than a restaurant on the NYC-NJ border. The final column reports the within state border effects between NYC and the NYC MSA, which are slightly smaller and imprecisely estimated.

7   Conclusion

In this paper, I estimate the effects of a minimum wage increase on restaurants' price and quality. I take advantage of a series of simultaneous minimum wage increases and the growing online presence of restaurants to investigate heterogeneity in price pass through across restaurant characteristics and item type, changes in customer perceived quality, and the existence of border effects. I find that prices increase between 0.3-1.2% in response to a 10% increase in minimum wage, results that are consistent with previous literature. Since the data used in this study are primarily non-chain and full service restaurants, these results are not being driven by large franchises and limited service establishments. This is an important

conclusion for policy makers, since small businesses are consistently at the forefront of concern. The most conservative pass through estimate, 0.33%, was calculated using the Yelp dataset. Only a quarter of these restaurants updated their menus throughout the course of the dataset, and thus may be interpreted as a lower bound of the true effects. The pass through results using the subset of restaurants who did update the menus is estimated at 1.22%, approximately four times that of the full sample. The pass through estimates using the Grubhub dataset, where the menus are necessarily up to date, gave a price pass through estimate of 0.91%.

The price pass through estimates differ across restaurant characteristics. For example, restaurants in the lowest quartile of size, determined by the number of employees, reported an estimated 1.0% pass through while restaurants in the highest quartile of employees reported an estimated 0.32% pass through. This suggests that smaller establishments have greater autonomy on menu pricing. The magnitude of the price pass through also varies at the item level, where items in categories such as "Popular" and "Sandwiches" show a pass through level of over 0.6%, but items in categories such as "Salads" and "Entres" show significantly lower levels of pass through, with estimates below 0.4%. This is an important indication for studies in the literature that only examine a small number of items on a menu over time.

I find a bimodal effect of an increase in the minimum wage on restaurant quality. Restaurants that were rated at the mean (3.5 stars) or below prior to the minimum wage increase saw a significant decrease in the star rating given to them by consumers after an increase in minimum wage. Restaurants that started at ratings above the mean saw a positive effect on their consumer ratings due to the increase in minimum wage. The Yelp star rating of a restaurant has been shown to significantly impact a restaurant's profit, thus these estimates are economically significant. Although there is no definitive answer as to what mechanism(s) is (are) driving these effects, I propose some possibilities. The positive relationship of highly rated restaurants could be an indicator that an increase in minimum wage acts as an efficiency wage for higher quality restaurants. The negative relationship, however, could indicate that lower quality restaurants may be cutting corners on food quality, service quality, or employment. Since these ratings are all conditional on consumer expectations, it may also be that an increase in price at lower rated restaurants changes the customer's expectation of what the quality level should be. If this were the case, then true quality may not change for the lower rated restaurants but the quality conditional on the price has changed. In turn the relative quality of higher rated restaurants would be better in comparison to the low rated restaurants.

Lastly, I examine the extent to which a restaurant's proximity to a minimum wage policy border

affects the level of price pass through. Border effects are an area of concern for policy makers when it comes to enacting local minimum wage laws. For restaurants in NYC within twelve minutes of the NYC-NJ border, I find a significant relationship between restaurants' proximity to the border and the level of price pass through. Specifically, I estimate that a restaurant ten minutes further away from the border increased prices by 0.1-0.2 percentage points more than a restaurant on the border. The smaller estimate, 0.1 percentage points, was calculated using the Yelp dataset. The average price increase between October '16 and April '17 for Yelp restaurants in NYC within 12 minutes of the border was 0.79%. The larger estimate, 0.2 percentage points, was calculated using the Grubhub dataset. The average price increase between December '16 and April '17 for Grubhub restaurants in NYC within 12 minutes of the border was 1.3%. Thus these border effect estimates have significant economic implications. Overall, these data have provided the ability to look further into the effects of a minimum wage increase on restaurants and brought about new areas of exploration for further work to be done.

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8 Figures

Figure 1: Sample of Yelp Restaurants
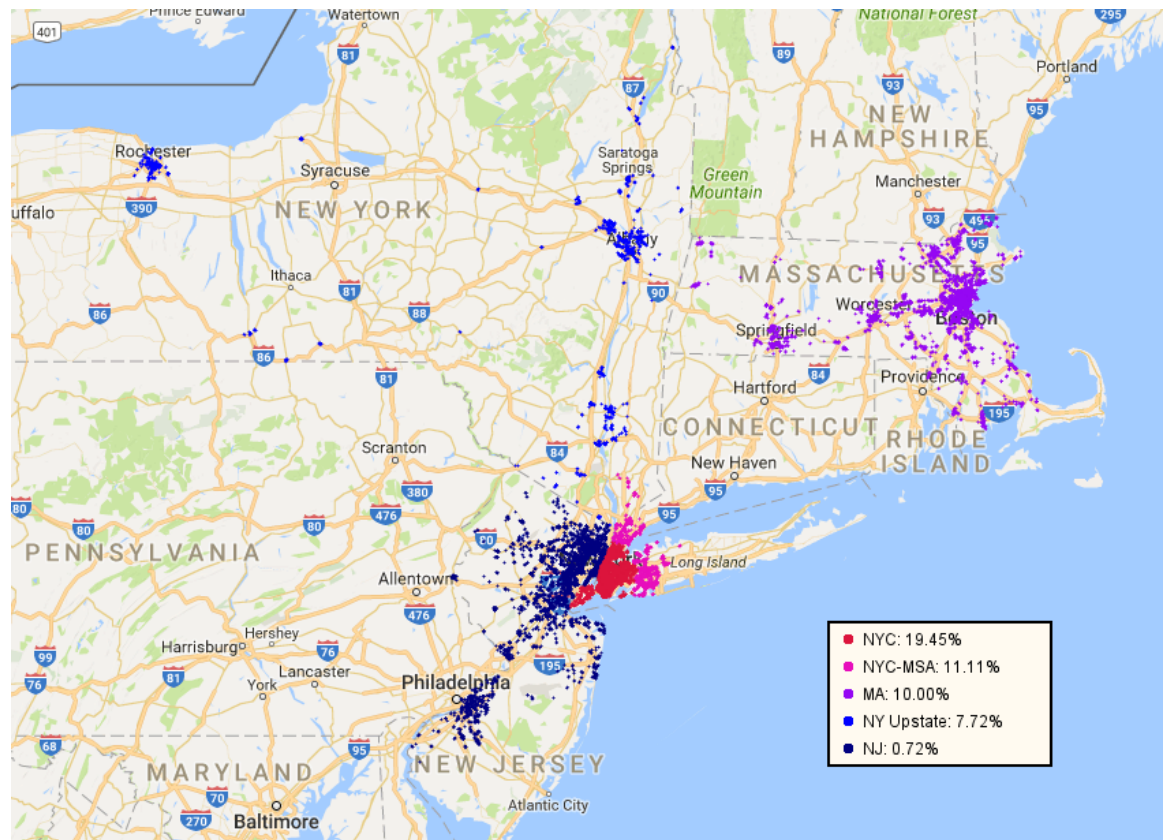
Notes: Each data point represents a restaurant in the Yelp dataset. Samples are color coded by the magnitude of the increase in minimum wage on January 1, 2017. NYC saw the highest increase in minimum wage at 19.45%. NYC-MSA, which includes Nassau, Suffolk, and Westchester counties, saw the second highest increase at 11.11%. The minimum wage increased in MA by 10.00%, in Upstate NY by 7.72% and in NJ by 0.72%.

Figure 2: Quality Changes by Initial Quality Rating
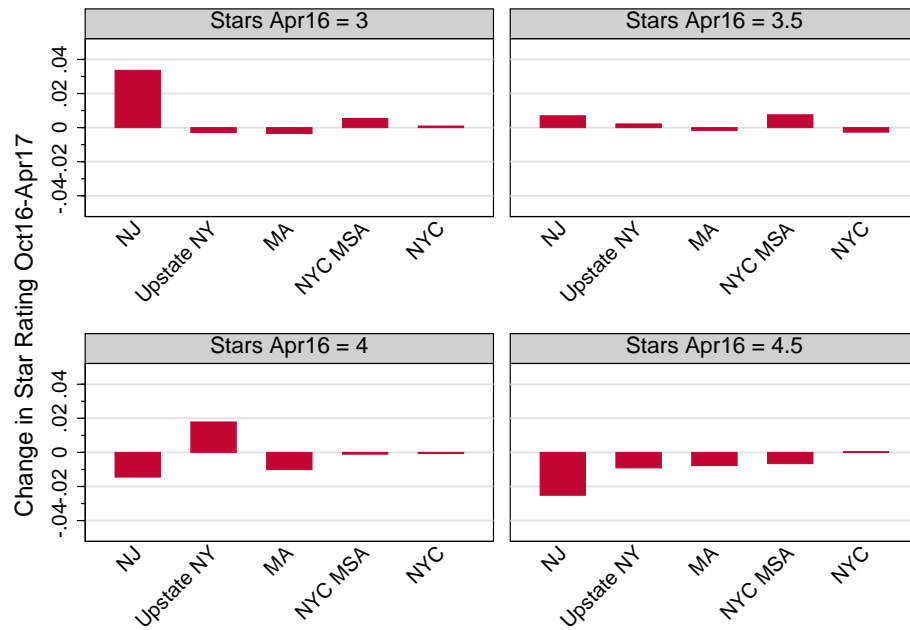
Notes: The figures show the relationship between the change in star rating from October 2016 to April 2017 and the change in minimum wage by initial quality rating. The minimum wage groups are reported in ascending order with respect to the increase in minimum wage that occurred in January 2017. The initial star value is the Yelp consumer rating of the restaurants in April 2016. Change in star rating is reported as percentage change. All restaurants that have a star rating throughout the dataset are included in the plots.

Figure 3: Geographic Location of Restuarants in NYC, NYC-MSA and NJ
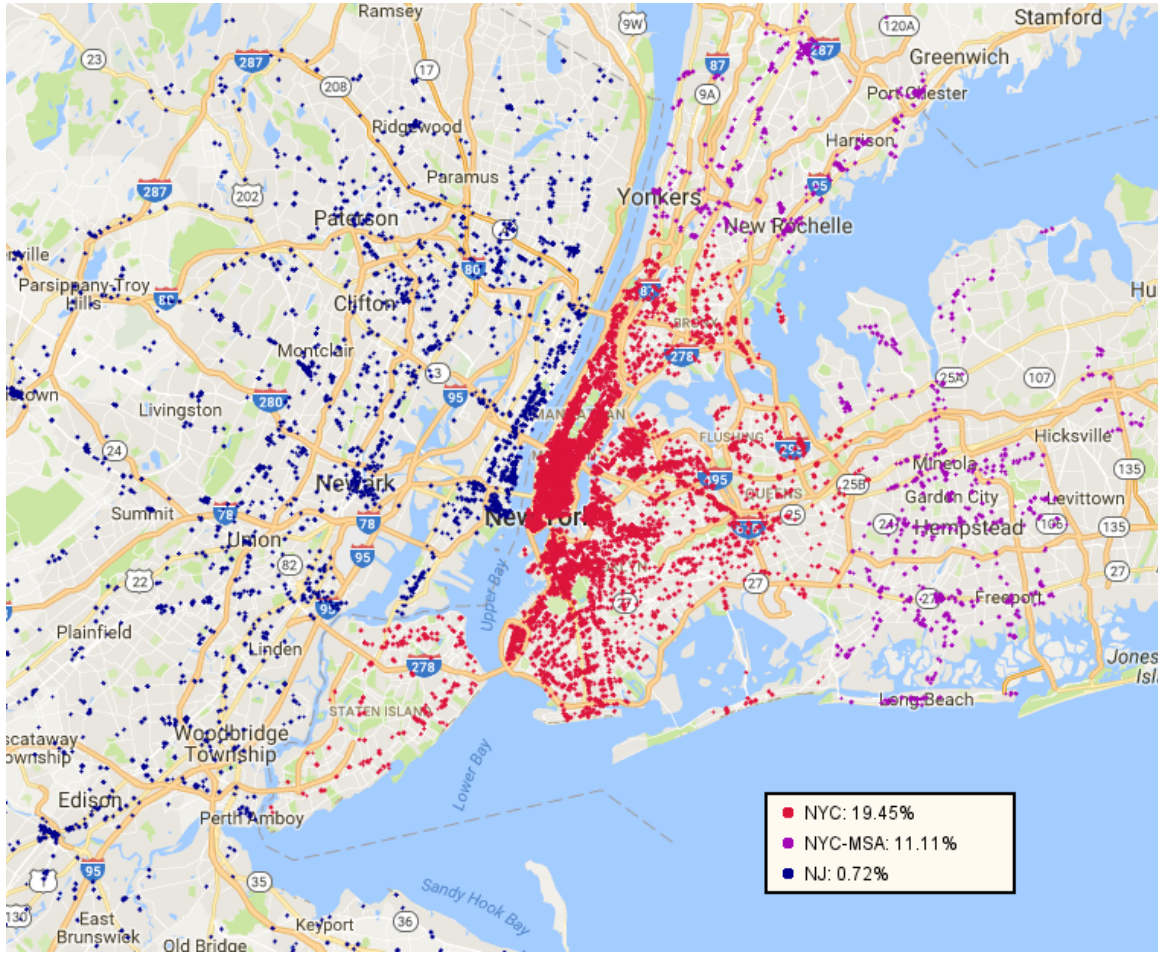

Notes: Each data point represents a restaurant in the Yelp dataset. Samples are color coded by the magnitude of the increase in minimum wage from 2016-2017. NYC saw the highest increase in minimum wage at 19.45%, NYC-MSA saw the second highest increase at 11.11%, and NJ saw the lowest increase at 0.72%. This close up view depicts the restaurants in the three minimum wage groups that are used for the border effects analysis.

Figure 4: Border Effects: Price Pass Through by Distance to NYC/NJ Border
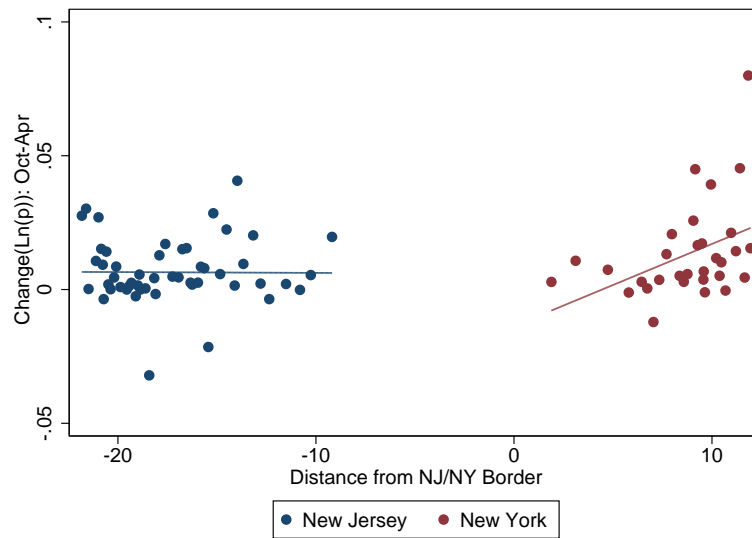
Notes: The figure shows the relationship between the change in price from October 2016 to April 2017 and the distance to the NYC- NJ border. Restaurants are binned into 80 quantiles. There is a gap between the NYC and NJ restaurants due to the Hudson river which separates the two states. Distance is measured in driving minutes to the nearest restaurant on the opposite side of the border.

9   Tables

Table 1: Minimum Wage Policy Changes

	Regular Minimum Wage			Tipped Minimum Wage		
Area	'16	'17	%Δ	'16	'17	%Δ
NYC & Lg	$9.00	$11.00	22.22%	$7.50	$7.50	0.00%
NYC & Sm	$9.00	$10.50	16.67 %	$7.50	$7.50	0.00%
NYC MSA	$9.00	$10.00	11.11%	$7.50	$7.50	0.00%
NY Upstate	$9.00	$9.70	7.78%	$7.50	$7.50	0.00%
New Jersey	$8.38	$8.44	0.72%	$2.13	$2.3	0.00%
Massachusetts	$10.00	$11.00	10.00%	$3.00	$3.75	25.00%

Notes: The regular and tipped minimum wage changes from 2016 to 2017 are reported by group. The first two rows show the minimum wage changes for restaurants in NYC. For the main analysis I use the average of the two minimum wage changes, 19.45%, for all restaurants in NYC. The NYC MSA group consists of restaurants in the three contiguous counties to NYC: Nassau, Suffolk, and Westchester. NY Upstate encapsulates restaurants in all other areas of the state. NJ and MA minimum wage laws are consistent throughout each state. Although there was a change in tipped minimum wage in Massachusetts, the analysis in this paper will focus only on impacts of changes in the regular minimum wage.

Table 2: Yelp Restaurant Summary Statistics by Minimum Wage Group

	(1) NYC	(2) NYC MSA	(3) MA	(4) NY Upstate	(5) NJ
Min Wage Increase	0.194	0.111	0.100	0.078	0.007
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Price (Apr16)	9.781	10.703	9.891	9.622	9.869
	(7.030)	(6.545)	(5.541)	(8.544)	(7.737)
Change Price (Oct16-Apr17)	0.008	0.007	0.005	0.001	0.004
	(0.070)	(0.088)	(0.053)	(0.019)	(0.073)
Increase	0.145	0.089	0.115	0.040	0.085
	(0.353)	(0.285)	(0.319)	(0.197)	(0.280)
Decrease	0.041	0.025	0.028	0.015	0.032
	(0.199)	(0.157)	(0.164)	(0.123)	(0.177)
Price Change ‖ Increase	0.083	0.108	0.064	0.048	0.087
	(0.110)	(0.260)	(0.125)	(0.065)	(0.215)
Price Change ‖ Decrease	-0.100	-0.089	-0.097	-0.048	-0.095
	(0.210)	(0.157)	(0.100)	(0.063)	(0.118)
Eat24 Restaurants	0.309	0.250	0.201	0.141	0.224
	(0.462)	(0.434)	(0.401)	(0.348)	(0.417)
Sales (100k)	8.489	7.597	9.233	5.019	5.631
	(14.245)	(37.176)	(19.165)	(5.988)	(9.583)
Employees	10.836	10.227	14.603	10.222	9.267
	(15.415)	(20.926)	(24.594)	(11.832)	(15.260)
Limited Service	0.042	0.072	0.019	0.069	0.043
	(0.201)	(0.258)	(0.135)	(0.254)	(0.202)
Franchise	0.001	0.006	0.016	0.000	0.010
	(0.029)	(0.077)	(0.126)	(0.000)	(0.097)
N	4242	595	1658	519	1793

Notes: The means and standard deviations of the primary dataset, Yelp, are reported. Each column contains the restaurants that fall into a specific minimum wage group. All data is balanced at the item level across time periods and aggregated at the restaurant level. The third row reports mean change in natural log of the price, which is approximately the percentage change. The rows titled "Increase" and "Decrease" report the percentage of restaurants that increased or decreased the averaged menu item price between Oct '16 and Apr '17. The conditional price changes are once again calculated from Oct '16 to Apr '17.

Table 3: Grubhub Restaurant Summary Statistics by Minimum Wage Group

	(1) NYC	(2) NYC MSA	(3) MA	(4) NY Upstate	(5) NJ
Min Wage Increase	0.194	0.111	0.100	0.078	0.007
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Price (Dec16)	9.602	9.974	9.388	8.568	9.007
	(4.499)	(3.890)	(4.273)	(2.976)	(3.999)
Change Price (Dec16-Apr17)	0.014	0.011	0.009	0.012	0.007
	(0.037)	(0.028)	(0.037)	(0.030)	(0.030)
Increase	0.375	0.358	0.295	0.358	0.294
	(0.484)	(0.480)	(0.457)	(0.481)	(0.456)
Decrease	0.058	0.043	0.054	0.082	0.072
	(0.233)	(0.204)	(0.226)	(0.275)	(0.258)
Price Change ‖ Increase	0.040	0.032	0.036	0.036	0.029
	(0.046)	(0.038)	(0.050)	(0.038)	(0.041)
Price Change ‖ Decrease	-0.019	-0.012	-0.028	-0.012	-0.022
	(0.045)	(0.026)	(0.073)	(0.022)	(0.051)
Sales (100k)	8.919	3.278	5.319	4.739	2.930
	(44.210)	(4.281)	(8.395)	(6.656)	(2.928)
Employees	10.096	5.780	8.519	9.730	5.013
	(19.315)	(7.350)	(13.380)	(14.124)	(5.018)
Limited Service	0.044	0.073	0.028	0.075	0.064
	(0.206)	(0.261)	(0.165)	(0.265)	(0.246)
Franchise	0.004	0.009	0.014	0.025	0.000
	(0.067)	(0.093)	(0.117)	(0.157)	(0.000)
N	1560	232	687	159	1016

Notes: The means of the secondary dataset, Grubhub, are reported. Each column contains the restaurants that fall into a specific minimum wage group. All data is balanced at the item level across time periods and aggregated at the restaurant level. The third row reports mean change in natural log of the price, which is approximately the percentage change. The rows titled "Increase" and "Decrease" report the percentage of restaurants that increased or decreased the averaged menu item price between Dec '16 and Apr '17. The conditional price changes are once again calculated from Dec '16 to Apr '17.

Table 4: Main Price Pass Through Results

	Yelp				Grubhub	
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Cntrls	Change	Eat24	All	Cntrls
$Jul16 - Oct16$	0.084	0.023	0.378	0.313		
	(0.040)	(0.067)	(0.178)	(0.212)		
$Oct16 - Jan17$	0.171***	0.185**	0.668**	0.326**		
	(0.034)	(0.064)	(0.198)	(0.114)		
$Jan17 - Apr17$	0.162***	0.148*	0.556*	0.272		
	(0.034)	(0.059)	(0.202)	(0.183)		
$Dec16 - Jan17$					0.260***	0.271***
					(0.010)	(0.007)
$Jan17 - Feb17$					0.245***	0.293***
					(0.042)	(0.028)
$Feb17 - Mar17$					0.244***	0.295***
					(0.022)	(0.015)
$Mar17 - Apr17$					0.162***	0.161***
					(0.013)	(0.023)
$Total\ Pass\ Through$	0.333***	0.333***	1.224***+	0.598**	0.911***	1.019***+
	(0.066)	(0.114)	(0.394)	(0.281)	(0.053)	(0.069)
N	8805	5257	2099	2269	3653	2760
NxT	35220	21028	8396	9076	14612	11040

p¡0.1; ** $p < 0.05$; *** $p < 0.01$; + statistically different than respective 'All' column

Notes: The outcome variable for all columns is the log change in price at the restaurant level due to a 10% increase in minimum wage. All errors are clustered at the minimum wage group level. Each row represents the amount of pass through occurring in the lag, lead(s), and contemporaneous time periods of the minimum wage changes. Columns 1-5 report estimates using the Yelp data. The first column includes the full sample. The second column includes the vector of controls from the RUSA dataset. The third column includes only restaurants that changed at least one item over the time period of the dataset. Column 4 includes the subsample of restaurants who employ the Eat24 food delivery service. Columns 5 and 6 report price pass through estimates using the Grubhub sample. Column 6 includes all restaurants and column 7 includes a vector of RUSA control variables.

Table 5: Price Pass Through By Restaurant Characteristics

	(1) Low Sales	(2) High Sales	(3) Low Emps	(4) High Emps	(5) Low Stars	(6) High Stars
$Jul16 - Oct16$	-0.085	-0.145	0.466	-0.077	-0.073	0.064
	(0.078)	(0.146)	(0.316)	(0.158)	(0.061)	(0.041)
$Oct16 - Jan17$	0.069	-0.013	0.492*	-0.013	0.204***	0.060
	(0.065)	(0.100)	(0.209)	(0.107)	(0.025)	(0.034)
$Jan16 - Apr17$	0.121**	0.344**	0.514*	0.330**	0.143**	0.105
	(0.039)	(0.112)	(0.239)	(0.117)	(0.047)	(0.065)
$Total\ Pass\ Through$	0.191**	0.331*	1.006**+	0.318*+	0.346***+	0.165**+
	(0.102)	(0.207)	(0.447)	(0.222)	(0.05)	(0.098)
N	1333	1490	1485	1842	2022	4973
NxT	5332	5960	5940	7368	8088	19892

p¡0.1; ** $p < 0.05$; *** $p < 0.01$; + statistically different than comparison group

Notes: The outcome variable for all columns is the log change in price at the restaurant level using the Yelp dataset. All errors are clustered at the minimum wage group level. The reported values compare price pass through of restaurants in the lowest and highest quartiles based on sales, employees, and number of stars in April 2016. Sample sizes are smaller for columns (1)-(4) since these restaurant characteristics rely on the RUSA data.

Table 6: Price Pass Through By Item Type

	(1) All	(2) Popular	(3) Side	(4) Sandwich	(5) Soup/Salad	(6) Entre	(7) Dessert	(8) Drink
$Dec16 - Jan17$	0.156***	0.179***	0.165***	0.210***	0.144***	0.147***	0.126***	0.166***
	(0.008)	(0.004)	(0.013)	(0.004)	(0.003)	(0.002)	(0.016)	(0.003)
$Jan17 - Feb17$	0.160***	0.231***	0.200**	0.220***	0.067**	0.155***	0.114***	0.211***
	(0.020)	(0.003)	(0.053)	(0.005)	(0.017)	(0.013)	(0.022)	(0.029)
$Feb17 - Mar17$	0.146***	0.143***	0.259***	0.231***	0.124***	0.050***	0.102**	0.036
	(0.011)	(0.014)	(0.019)	(0.014)	(0.005)	(0.006)	(0.023)	(0.041)
$Mar17 - Apr17$	0.014	0.065**	0.067**	0.024	-0.003	0.013	0.014	-0.002
	(0.010)	(0.015)	(0.017)	(0.037)	(0.008)	(0.007)	(0.024)	(0.018)
Total Pass Through	0.477***	0.617***+	0.691***+	0.684***+	0.331***+	0.365***+	0.356***	0.412***
	(0.034)	(0.027)	(0.064)	(0.026)	(0.021)	(0.01)	(0.081)	(0.041)
N	435676	23845	53227	56750	23447	81176	9963	31757
NxT	1742704	95380	212908	227000	93788	324704	39852	127028

p¡0.1; ** $p < 0.05$; *** $p < 0.01$; + statistically different than column (1)

Notes: The outcome variable for all columns is the log change in price at the item level using the Grubhub dataset. All errors are clustered at the minimum wage group level. The item categories listed above are mutually exclusive but not exhaustive. The additional food categories not listed include; appetizer, kids, pizza, and other.

Table 7: Quality Changes

	(1)	(2)	(3)	(4)	(5)	(6)
	All	2.5	3.0	3.5	4.0	4.5
$Jul16 - Oct16$	-0.083	-1.459	-0.930	0.041	1.304	-0.165
	(0.198)	(1.208)	(0.743)	(0.242)	(0.793)	(0.820)
$Oct16 - Jan17$	-0.110	-0.883	-1.966*	-0.335	1.479*	1.097
	(0.166)	(2.221)	(0.867)	(0.207)	(0.539)	(0.533)
$Jan17 - Apr17$	-0.415	-2.296	-1.171	-0.796*	0.912	0.372
	(0.354)	(1.751)	(1.201)	(0.327)	(0.686)	(0.563)
Total % Change Stars	-0.526	-3.179	-3.136*	-1.131***	2.391**	1.468*
	(0.451)	(3.969)	(2.021)	(0.486)	(1.185)	(1.008)
N	6817	625	1080	1801	1904	982
NxT	27268	2500	4320	7204	7616	3928

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The outcome variable for all columns is the log change in Yelp star rating. All errors are clustered at the minimum wage group level. The initial star ratings are the rounded Yelp star ratings in April 2016. Restaurants below a 2.5 rating and above a 4.5 rating are not analyzed as subsamples given that they are close to the lower and upper bounds, respectively, and so only have one direction to move.

Table 8: Border Effects

Source	Yelp			Grubhub	
	(1)	(2)	(3)	(4)	(5)
Comparison Area	NJ	NJ	NYC MSA	NJ	NYC MSA
Time Frame	Oct16-Apr17	Apr16-Oct16	Oct16-Apr17	Dec16-Apr17	Dec16-Apr17
$\mathbb{1}(NY)$ (α_1)	0.0064	-0.0064	0.0027	-0.0102	-0.0134
	(0.0152)	(0.0116)	(0.0355)	(0.0124)	(0.0128)
Distance (α_2)	-0.0009	0.0000	-0.0010	-0.0000	0.0003
	(0.0008)	(0.0006)	(0.0009)	(0.0006)	(0.0004)
Distance * $\mathbb{1}(NY)$ (α_3)	0.0020*	0.0007	0.0016	0.0019**	0.0011
	(0.0011)	(0.0009)	(0.0037)	(0.0009)	(0.0012)
Constant (α_0)	-0.0069	0.0041	-0.0034	0.0059	0.0137**
	(0.0134)	(0.0102)	(0.0134)	(0.0101)	(0.0059)
$\alpha_2 + \alpha_3$	0.0011*	0.0007	0.0005	0.0018***	0.0014
	(0.0008)	(0.0006)	(0.0035)	(0.0007)	(0.0011)
N	1002	1002	522	694	231

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Notes: The outcome variable is the percentage point change in price due to a 10 minute change in the distance of a restaurant to the border. The first column includes restaurants in the Yelp dataset within twelve minutes of the NYC - NJ border between October 2016 and April 2017. Column 2 includes these same restaurants but using the change in price from July 2016 to October 2016 as the outcome. Column 3 also uses restaurants in the Yelp datatset but includes only restaurants close to the NYC-NYC MSA border. Columns 4 and 5 include restaurants in the Grubhub dataset. Column 4 reports effects on the NYC-NJ border and column 5 reports effects on the NYC-NYC MSA border.