How Do Restaurants Pay For the Minimum Wage?*

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Abstract

Policies that increase minimum wages do not specify how the increased wages should be paid for. However, they need to be paid for somehow. Using confidential data from a national restaurant chain, I analyze the minimum wage incidence of all potential payees. I find employees help pay for increased minimum wages through reduced hours worked, but not through lower employment levels. I also find customers help cover costs by paying higher prices, but they reduce their quantity demanded. The results also show that restaurant owners help cover the increased wages through lower operating profits.

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JEL Classifications: J31, J38, L23

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1 Introduction

When any government passes legislation to increase the minimum wage that must be paid to workers under their jurisdiction, the legislators do not need to specify how they are going to fund the increased wages for private sector workers. It is the responsibility of each firm affected by the increased minimum wage to determine how best to pay for the higher wages due its workers. There are four possible channels to pay for the higher wages. Broadly speaking, employees could pay for the higher minimum wage through lower employment levels or through more compressed wage distributions. Secondly, customers could pay for higher minimum wages by paying higher prices for the final product. Third, owners could pay for higher minimum wages through lower operating profits. Finally, the firm could absorb the higher wage costs by changing its production function or adjusting its use of other inputs.

Most of the literature analyzing the impact of increased minimum wages has focused on the first channel of adjustment, that of firms reducing employment (see Card and Krueger (1995), Brown (1999), and Neumark and Wascher (2008) for excellent surveys). There have been other studies analyzing other channels of adjustment (for example, Giuliano (2013) on workforce composition, Katz and Krueger (1992) on employment benefits, Dube, Naidu and Reich (2007) on wage distribution, Aaronson (2001) and Lemos (2008) on output prices, Draca, Machin and van Reenen (2011) on firm profits, and Gittings and Schmutte (2016) on employment turnover), but to the best of my knowledge, this is the first study to have access to data from the United States by which all four channels can be studied simultaneously.[1]

This study uses a confidential restaurant-level dataset with quarterly financial data on over 500 restaurants in 13 states for the years 2006-2010. During this time, about half of the states implemented minimum wages that were above the national minimum wage, and the other half of the states saw their minimum wage increase as the federal minimum increased

[1]Harasztosi and Lindner (2018) study the incidence of the minimum wage using matched employer-employee data from Hungary.

from $5.15 to $7.25.

I use restaurant-level variation in the cost of compliance with new minimum wages to measure exposure to changes in the minimum wage. I then employ standard difference-in-differences methods to measure the extent to which restaurants use the four channels of adjustment to respond to minimum wage changes. After analyzing how firms respond in specific ways, I then analyze how much of the cost of increased minimum wages is paid for by the various channels. In order to do this, I need to make assumptions about what is the true cost of the minimum wage to each restaurant. The total cost of the minimum wage depends upon the internal wage distribution within a particular restaurant, and how that distribution should adjust to the new minimum wage. For example, how much of a raise should workers already making $7.25 receive when the minimum wage is raised to $7.25? While the data shows how wages change at each restaurant, I do not know the optimal adjustment. Therefore, I consider four possible adjustments to the wage distribution at each restaurant, a lower bound, an upper bound, and two adjustments observed in other contexts (Neumark, Schweitzer and Wascher, 2004; Dube, Giuliano and Leonard, 2015).

Depending on the assumption about the true cost of the minimum wage, I find that employees pay between 50% and 87% of the total cost of the minimum wage increase. I find that employees help pay for the minimum wage through reduced hours worked and not through a lower level of employment. Customers do face higher product prices, but they do not help pay for higher minimum wages as their reduced demand results in lower total sales. For the third channel, I do not find any evidence that restaurant owners help pay for the minimum wage through lower operating profits. For the fourth channel, I find mixed evidence that restaurants adjust their production function to help cover the costs of increased minimum wages.

This study makes two primary contributions to the literature. First, I am able to directly analyze the impact of minimum wage increases on operating profits. Second, due to the comprehensive nature of the data, I am able to simultaneously analyze multiple channels of

adjustment for restaurants in the United States.

The paper proceeds as follows. The next section discusses the previous literature related to this study. The third section describes the data and the minimum wage changes being studied. The fourth section then describes the empirical methodology. The fifth section presents the results for the impact of minimum wages on employment, customers, owners, and the production function. The next section then estimates for the relative shares of minimum wage costs borne by each channel of adjustment. The last section concludes.

2 Related Literature

The two papers that are most closely related to this one also use confidential store level data to analyze the impact of minimum wage increases (Hirsch, Kaufman and Zelenska, 2015; Giuliano, 2013). Hirsch, Kaufman, and Zelenska (2015) use confidential payroll data from over 80 quick-service restaurants across Georgia and Alabama. They have data for the years 2007-2009, during which the US minimum wage increased by 70 cents in July of each of the three years. Using detailed payroll data, the authors are able to measure how much each restaurant would have to raise their wages to bring all of their employees into compliance with the new minimum wages. These restaurant level measures of compliance costs provide the variation across restaurants used to identify the impact of the minimum wage. Hirsch, Kaufman, and Zelenska find that restaurants with higher compliance costs do not experience a significant decrease in employment or hours after the minimum wage increases. Hirsch, Kaufman, and Zelenska go on to examine other channels of adjustment on the part of the restaurants, primarily through a survey of restaurant managers, which I discuss in more detail below.

Giuliano (2013) used confidential payroll data from over 700 retail stores nationwide to examine the impact of the 1996 increase in the federal minimum wage. She also finds that stores more impacted by minimum wage increases did not have significant decreases in

employment. However, she does find that stores substituted away from older workers towards younger workers. Giuliano also finds some evidence that higher minimum wages increased teenage labor force participation, and this effect occurred mostly in wealthier neighborhoods.

More recently Harasztosi and Lindner (2018) use matched-employer-employee data from Hungary to examine a large increase in the minimum wage in 2001. They find large effects on workers' wages, but small effects on employment. They also show that customers pay for most of the increased costs through higher output prices.

While these three papers are most closely related to mine, other papers have examined the various other responses that firms could have to increased minimum wages. The channel of adjustment which has been most studied in the literature is the employment channel. Good summaries of this literature can be found in Card and Krueger (1995), Brown (1999), and Neumark and Wascher (2008).

In addition to firms directly adjusting the level of employment, firms could offset the cost of increased minimum wages through the employment channel by reducing the level of benefits provided to workers or by compressing the wage distribution. While most work environments for minimum wage workers do not provide a lot of benefits for their workers in the form of health or retirement benefits, many restaurants do provide free or reduced meals and uniforms for their workers. Restaurant owners could change the value of these in-kind benefits to help offset the increased wage costs. Hirsch, Kaufman, and Zelenska did not analyze fringe benefits as the hourly workers in their sample did not receive any (2015). In two studies that directly analyzed whether firms reduced benefits, Card and Krueger (1994) and Katz and Krueger (1992) do not find that firms changed the amount of benefits given to workers after minimum wages increased.

With regards to the wage distribution of workers, standard theories do not provide a clear explanation for what is observed in the literature. If the labor market is perfectly competitive, than all workers performing the same job would receive the same pay. However, this is not the case both within restaurants and across restaurants (Card and Krueger, 1995).

Not only is there evidence of workers receiving different wages for doing the same job, there is also evidence that workers of different productivity levels receiving the same wage. So, if there is a distribution of wages paid to similar workers, how does the minimum wage impact that distribution? Stigler (1946) argued the minimum wage takes a bite out of the wage distribution, with firms dismissing workers who had marginal revenue productivities below the minimum wage. However, Card and Krueger (1995) find that firms have substantial spikes of workers exactly at the minimum wage.

A few studies have investigated how changes in the minimum wage impact the wage distribution. Hirsch, Kaufman, and Zelenska, in their survey of restaurant managers, found that 40% of managers indicated they would delay bonuses and raises for more experienced workers, thus compressing the wage distribution within a restaurant in the short-run (2015). In their empirical analysis, Hirsch, Kaufman, and Zelenska do not find any evidence that workers above the new minimum wage received raises. Grossman (1983) found that minimum wage increases compressed the wage distribution in the short-run, but not the long-run. Katz and Krueger (1992) found that managers would provide raises for workers earning above the minimum wage, but the percent of managers willing to do so decreased as the minimum wage increased further. Neumark, Schweitzer, and Wascher (2004) examined the effects nationally, and find significant increases in wages for workers earning up to 3 times the new minimum wage. Phelan (2016) finds evidence of spillovers across occupations whereas Gindling and Terrell (2007) find no evidence of spillovers to the uncovered sector in Costa Rica. Finally, Dube, Naidu, and Reich (2007) found that San Francisco's minimum wage policy worked to compress wage inequality at both fast-food and table-service restaurants.

The second major channel of adjustment is for firms to pass on the higher labor costs to consumers. Firms could do this directly through higher output prices, or indirectly through lower product quality or customer service. Lemos (2008) provides a survey of the literature on the effects of minimum wages on prices, and finds that a 10% increase in the minimum wage would result in a 4% increase in food prices. One of the more notable studies on this

topic is Aaronson's (2001). He uses multiple data sources on restaurant prices from Canada and the United States, and finds that stores raise prices about the same time as the minimum wage change, with a 10% increase in the minimum wage leading to a 0.7% increase in prices. Card and Krueger's (1994) study of restaurants in New Jersey and Pennsylvania found the price of a basic combo meal increased 4% faster in New Jersey after the minimum wage change than it did in Pennsylvania. While most of the evidence indicates that companies are able to offset at least some of the increased labor costs by raising output prices, some studies have not found statistically significant evidence that they do (Katz and Krueger, 1992; Machin, Manning and Rahman, 2003; Draca, Machin and van Reenen, 2011).

MaCurdy takes a different approach to measuring how customers might pay for minimum wage increases by examining the distributional impacts of minimum wages (2015). He finds that as firms increase output prices in response to minimum wage increases, this has a larger impact on low-income families. He also finds that the higher earnings resulting from higher minimum wages are distributed relatively evenly across the income distribution. So, while some low-income families are net winners, with their earnings increasing more than their costs, most low-income families are net losers.

The other way customers could pay for higher minimum wages would be through lower product quality. This could occur along any number of dimensions. Restaurant owners could reduce the number of times they clean the bathrooms, provide fewer condiments with each order, or reduce the amount of energy used to heat/cool the dining room. In this study, individual restaurants could reduce food costs by not throwing away food as quickly as regulated. There could also be confounding effects of changes to the labor force that could impact product quality. For example, if a restaurant reduces its level of employment, each remaining worker would have to be more productive, potentially leading them to be more hurried, smile less often, and make more mistakes. In this paper, I will be able to analyze many of these dimensions of product quality through the use of customer satisfaction surveys. Product quality is also impacted through production decisions, such as how much to spend

on cleaning supplies, and these aspects of product quality will be analyzed as a part of the production function channel of adjustment.

The third major channel of adjustment is on the part of firm owners. If the firm is in a competitive output market and unable to increase its output price, then increased costs would lead to lower profits for the firm. However, if the cost shock is an industry wide shock, then the market price could adjust upwards, allowing firms to offset the labor cost shock. The higher price could influence customers to reduce their demand for the final product, working to lower revenue for the firm. While basic theory does not provide a clear prediction for how minimum wages would impact profits, a few papers in the literature have developed arguments for why profits would not be affected by minimum wage increases. Card and Krueger (1995) develop an efficiency wage model to show that minimum wage increases do not reduce profits for firm owners. Rebitzer and Taylor (1995) show that in an employment matching model with many employers, minimum wage increases also do not reduce profits. MaCurdy (2015) argues that firm owners of large, publicly traded firms will not face lower profits due to the efficient nature of capital markets.

Empirically, a few papers have analyzed the effect of minimum wage increases on profits. Card and Krueger (1995) take an event study approach using firm stock prices and identify various news events which could have provided information about the federal minimum wage changes in 1991 and 1992. They do not find large negative impacts on firm stock prices, though they admit it is hard to identify exactly which pieces of information caused investors to change their expectations about future firm profitability. Bell and Machin (2016) address that concern by analyzing an unexpected change in United Kingdom's minimum wage, and its impact on firm stock prices. They find that stock prices of firms who hire low-wage workers fell by 2 to 3% within five days after the announcement, which is roughly equal to the expected decrease in profitability associated with the announcement. Draca, Machin, and Van Reenen (2011) use publicly available annual accounting information for both private and public firms in the United Kingdom to analyze the impact of the 1999

national minimum wage. They find a small negative effect on profits. In Aaronson, French, Sorkin, and To's (2018) study on industry dynamics, they find the elasticity of accounting profit with respect to minimum wages to be -0.01. Hirsch, Kaufman, and Zelenska (2015) find suggestive evidence of a negative effect on profits, but are unable to disentangle the effect of minimum wages from other cost increases. However, their survey of restaurant managers reports the higher minimum wage contributed to a difficult business environment in the medium to long-run. The study in this paper directly analyzes the impact of minimum wage increases on operating profits using restaurant level data.

The last channel of adjustment for firms is through the production function. It is possible that firms could absorb higher labor costs by tightening work schedules, reducing food waste, cleaning less often, or by expecting employees to be more productive. The survey of restaurant managers conducted by Hirsch, Kaufman, and Zelenska (2015) provides a lot of insight into this channel. They report that 90% of respondents indicated they would increase performance standards for their workers, and that this channel was a "very important" way for them to offset minimum wage costs. They also report that 92% of respondents wanted to boost team morale so the workers would be more productive. Hirsch, Kaufman, and Zelenska also argue that while standard theory assumes firms are constantly cost minimizing, it may be that the minimum wage increase provides a shock to managers causing them to look for more ways to minimize costs.

Another way firms could minimize costs is through lower employment turnover. For many firms that pay low-wages, there are high levels of turnover. Turnover is costly to firms, as they regularly need to recruit and train new workers. Hirsch, Kaufman, and Zelenska (2015) report that two owners estimated turnover costs of $300 to $400 per employee. Higher minimum wages could work to reduce turnover as workers earning higher wages are less likely to quit.

A number of recent studies have directly examined the impact of minimum wages on employee turnover. Gittings and Schmutte (2016) provide a useful overview. In Hirsch,

Kaufman, and Zelenska's (2015) detailed restaurant data, they find weak evidence of higher minimum wages leading to lower turnover. Dube, Lester, and Reich (2016) examine turnover both for teenagers and the restaurant sector and find that higher minimum wages lead to both lower separations and lower hires. Gittings and Schmutte (2016) find evidence of higher minimum wages leading to lower turnover, and go on to show that reduced employment turnover helps mitigate the costs of higher minimum wages. There is not much literature analyzing the impact of minimum wages on other production decisions as the data is difficult to come by. This paper is able to address some of those gaps.

3 Data and Setting

The data made available for this project is from a national restaurant chain for the years 2006-2010. For confidentiality reasons, restaurants were randomly selected to be included in the dataset if the restaurant was located in a state with at least 30 restaurants in 2010. For example, if Nebraska had 30 restaurants in 2010, 15 restaurants were chosen at random from Nebraska to be included in the dataset. Given this selection criteria, the dataset contains 8,975 restaurant-quarter observations, covering 515 restaurants in 13 states. The data is extensive and includes information on basic restaurant characteristics, income and expenses for each restaurant, payroll by wage groups, customer satisfaction reports, information on price changes, and some productivity measures.

For basic restaurant characteristics, the data identifies which state the restaurant was located in, but no more detailed information about its location. The data also indicates whether the restaurant was located in a mall or if it was a stand-alone restaurant, when the restaurant opened, a unique identifier for the restaurant owner, and when the restaurant owner took control of each restaurant.

The data also contains information on each restaurant's income and operating expenses. This includes both sales that were generated from within the restaurant, and from catering.

The data includes many separate expense categories, such as food costs, packaging costs, labor costs, utilities, linen, pest control, kitchen supplies, cleaning supplies, etc. However, for confidentiality reasons, some expense categories were suppressed so that each owner's profit level could not be calculated exactly. The categories that were suppressed were for occupancy costs, credit card fees, and franchise fees. The omission of this information should not affect the results of this study as owners are not able to manipulate these expenses in response to changes in the minimum wage.

The payroll information was grouped into \$0.25 wage buckets for each restaurant. The wage buckets are are <\$5.00, \$5.00-5.25, \$5.25-5.50, and so on up to \$14.75-15.00, and >\$15.00. For each category, the data provides the number of workers, number of male workers, total hours worked, average tenure, and gross earnings.

The results of customer satisfaction surveys are reported for five categories, "Overall", "Taste", "Speed", "Service", and "Cleanliness". For each category, the results are reported as the percent of respondents who provided a rating of "Excellent". The data also provides information on the total number of transactions each restaurant processed and a measure of employee turnover. The company would not disclose the exact formula used to calculate employee turnover, only that the number provided is a twelve month rolling average.

Summary statistics are reported in Table 1. The statistics are reported separately for restaurants located in malls and stand-alone restaurants, as stand-alone restaurants are twice as big as mall restaurants both in terms of overall sales and in number of employees hired [2]. Even though the two types of restaurants are different sizes, the cost structures are relatively similar. Both types of restaurants have total operating costs equal to about 65% of total sales. Wages comprise about 31% of total costs and food costs are about 44% of total costs. Mall restaurants are 14 years older than stand-alone restaurants on average. Owners of stand-alone restaurants have been been in charge for 5.5 years on average, whereas mall restaurant owners have been in charge for 6.8 years. Stand-alone restaurants have 60.6

[2]For confidentiality reasons, average total sales are not reported.

employees on their payroll in any given quarter, and those employees work 20.2 hours per week on average. Mall restaurants have 36.6 employees, who work 17.2 hours per week on average. Both types of restaurants employ more females than males, with females comprising almost 60% of the workforce. The average employee has been at the restaurant for just under 2 years, and earns a hourly wage rate of $9.46 in stand-alone restaurants and $9.07 in mall restaurants (the difference is statistically significant, with a t-stat of 17.4).

There are a number of minimum wage changes which occurred during the years 2006-2010. In May of 2007, the US government passed the *Fair Minimum Wage Act* that would raise the federal minimum wage from $5.15 to $7.25. This change occurred in $0.70 increments in July of years 2007, 2008, and 2009. At the time when this law was passed, seven of the states in this study had minimum wages above the federal minimum's first increase. That is to say that California, Colorado, Florida, Maryland, North Carolina, Ohio, and Pennsylvania all had state minimum wages above $5.85 in 2007, so the first increase in the federal minimum wage did not impact them.

Four of these "High Minimum Wage States" (CO, NC, OH, and PA) did not have a state minimum wage higher than the federal level at the start of 2006, but then raised their state minimum wages above the federal level in January of 2007. California and Florida both had state minimum wages above the federal level in 2006, but then also increased their minimum wage even higher in January of 2007. Maryland had a minimum wage of $6.15 in 2006, and did not raise their minimum wage until the second federal increase of the minimum wage in July of 2008.

By the time the federal minimum increased in July of 2009 to $7.25, only California, Colorado, and Ohio had state minimum wages above $7.25. And even so, Colorado's minimum wage was only $7.28 and Ohio's was $7.30. These changes in the minimum wage are summarized in Table 2.

Figure 1 shows the trends for a few primary outcome variables over time. Each figure has a vertical line whenever some restaurants faced an increase in the minimum wage. The

top-left figure shows the trends in average hourly wages, and shows a consistent increase across the time periods. The top-right figure shows the trends in employment levels. The figure shows some seasonality in employment, but no secular trend. The bottom-left panel shows the trends for average total hours worked at each restaurant, and the pattern exhibits marked seasonality, with peaks in the first and third quarters of each year. The bottom-right panel shows the trends in employment turnover. This trend is much smoother as the measure is calculated as a 12-month rolling average. The figure shows an increase in turnover in the last two years of data.

A source of variation that has been used in the literature to identify the impact of changes in the minimum wage is the "Wage Gap" for each restaurant. This measure captures how much each restaurant would have to raise their wages to meet the new minimum wage. I construct the wage gap in a similar manner as Hirsch, Kaufman, and Zelenska (2015). The wage gap for restaurant j in period t is:

$$Gap_{jt} = 1 + \frac{\sum_{i<MW}(MW_{jt} - W_{ijt-1})H_{ijt-1}}{\sum_i W_{ijt-1}H_{ijt-1}}, \tag{1}$$

where MW_{jt} is minimum wage at restaurant j in period t, W_{ijt-1} is the wage earned by employee i at restaurant j in period $t-1$, and H_{ijt-1} is the number of hours worked by employee i at restaurant j in period $t-1$.

The numerator in the Gap_{jt} formula captures how much wages would have to increase to bring all employees up to the new minimum wage, assuming the number of hours each employee works does not change. The denominator is the total wage bill in the previous period. Adding 1 to the term converts the proportion to a wage ratio, and then using the natural log of $Gap_{jt}+1$ in a regression with log employment as the dependent variable results in estimates of the wage gap elasticity (Hirsch, Kaufman and Zelenska, 2015).

For example, if a restaurant had one employee that was being paid \$6.75 per hour in the second quarter of 2009. Then, in Q3 of 2009, the restaurant would have to raise that

employee's hourly wage \$0.50 in order to comply with the new minimum wage. The next step in calculating the Gap_{jt} is to multiply that employee's \$0.50 wage increase with the number of hours that employee worked in Q2 2009. This step assumes the hours worked by each employee stays constant across periods. The final step is to sum over each employee in a restaurant and divide by the restaurant's total wage bill to determine how much the restaurant would have to raise wages to comply with the new minimum wage.

Every state in the data experienced at least two minimum wage changes during the sample window, typically in incremental adjustments, with the future minimum wage change being known in advance of the initial adjustment. For example, the federal minimum wage adjustments were announced in May of 2007. Therefore, everyone knew the federal minimum wage change would increase by \$0.70 on each of the next three July 1st dates.

For each minimum wage change observed in the data, I calculate two measures of how much each restaurant is impacted by changes in the minimum wage. The first measure is the Gap_{jt} as described above, equal to the percentage change in wages that would have to occur to bring each employee's hourly wage up to the new minimum wage. The second measure of impact is the percentage of worker-hours that were worked by employees with hourly wages below the new minimum wage. The results of these measures are reported in Table 3.

Since these two measures of impact can only be calculated when there are changes in the minimum wage, Table 3 only shows results for the 6 quarters where minimum wage changes were observed in the data. The bottom row shows the impact when combining the incremental minimum wage changes into one large minimum wage change. The first two columns report the measures of impact on the restaurant overall. Column 3 then reports the number of restaurants that were impacted by changes in minimum wages in each period.

The first number reported in Table 3 indicates that the 163 restaurants who were impacted by the minimum wage change in January of 2007 would have to raise their wages by 0.7% on average to comply with the new minimum wage. Column 2 reports that on average, 9.7% of the hours worked at those restaurants in the previous quarter were worked

by employees whose hourly wage was below the new minimum wage.

Overall, Table 3 shows that the last change in the federal minimum wage, in July of 2009 had the largest impact on restaurants' wages. Each of the federal minimum wage changes impacted more restaurants with each increase. These estimates are smaller than those reported by Hirsch, Kaufman, and Zelenska (2015). They have actual pay data for about 80 restaurants in Alabama and Georgia from 2007-2009, and report an average wage gap of 2.6 in 2007, but 6.8 in 2009, and share of workers affected of 49.2% in 2007 and 82.2% in 2009.

4 Empirical Methods

The standard approach for measuring the impact of minimum wages is the difference-in-differences strategy popularized by Card and Krueger (1994) as they analyzed the impact of a change in the minimum wage in New Jersey in 1992. Formally, this method is represented by the following specification:

$$y_{jst} = \alpha + \beta ln(MW_{st}) + \delta Z_{st} + \gamma X_{jst} + \phi_j + \tau_t + \epsilon_{jst} \tag{2}$$

where y_{jst} is the outcome of interest for restaurant j in state s in quarter t. The independent variable of interest is the log of the relevant minimum wage in that state at time t. Z_{st} is a set of state level controls, which here include population in quarter t and the unemployment rate at time t. X_{jst} is for restaurant level control variables, which here is just the tenure of the owner of restaurant j. All models include restaurant fixed effects ϕ_j and period fixed effects τ_t[3].

One limitation of this approach is that all restaurants within a state are considered to experience the same magnitude of treatment. However, as mentioned above, some restaurants

[3]No restaurants change states, so state fixed effects are collinear with restaurant effects and therefore excluded.

are more impacted by changes in the minimum wage depending upon what the distribution of wages were prior to the minimum wage change. This restaurant level measure of treatment is what is captured by Gap_{jt}. The specification using Gap_{jt} to measure treatment is very similar to the standard specification:

$$y_{jst} = \alpha + \beta ln(Gap_{jt}) + \delta Z_{st} + \gamma X_{jst} + \phi_j + \tau_t + \epsilon_{jst} \tag{3}$$

Following the construction of Gap_{jt} used in Hirsch, Kaufman, and Zelenska (2015), the estimates of β in this specification are elasticities with respect to the wage gap.

As shown in Table 2, each state experienced multiple minimum wage changes during the study period. The table also shows the implementation dates for the minimum wage changes are staggered with the federal minimum wage changing in July of each year, whereas the states with higher minimum wages typically implement their minimum wage change in January. These two patterns are important for considering whether the standard counterfactual from the difference-in-difference methodology is appropriate. If restaurants either take longer than one quarter to fully respond to a change in the minimum wage or shift their full minimum wage response to be before or after future incremental changes in the minimum wage, noise is added to the standard difference-in-difference specification. For example, the counterfactual states for states responding to the federal minimum wage changes are the states that started with higher minimum wages and implemented their own minimum wage increase in January of the same year. If restaurants in these high minimum wage states take longer than two quarters to fully respond (Aaronson et al., 2018; Brummund and Strain, 2018), then restaurants in those states might be considered as counterfactuals for restaurants responding to the federal minimum wage change.

I use two event study approaches to create clean counterfactuals for the analysis. First, I consider each minimum wage change as its own treatment, but limit the treatment window to the two periods before the minimum wage change and the two periods after. Therefore,

each minimum wage change in the data has four observations, two of which are not-treated and two of which are treated. This approach has the advantage of analyzing every distinct minimum wage change observed in the data, and captures the short-run response of each restaurant. Two limitations of this approach are that it misses any adjustments that take longer than two quarters to be realized, and it doesn't account for the incremental changes in the minimum wage. The second approach addresses these concerns by consolidating the minimum wage changes in each state into one large treatment. In this approach, the three \$0.70 increases in the federal minimum wage are combined into one large \$2.10 increase. The treatment window for this large minimum wage change is then the four quarters before the first minimum wage changed and the four quarters after the last minimum wage change. This window applies similarly to states which increase their minimum wage at different intervals than the federal minimum wage changes. This approach considers one treatment for each store, and I collapse the four quarters before and after the combined minimum wage change resulting in at most two observations for each store in the data.

A few other econometric concerns need to be addressed. First, standard errors are clustered at the state level in all specifications because minimum wages are determined at the state level, and so the error term is likely to be correlated for restaurants in the same state over time (Bertrand, Duflo and Mullainathan, 2004). Donald and Lang (2007) have an important paper identifying issues with inference when using difference-in-differences methods on samples that have small numbers of groups. This paper addresses those concerns by first noting that the sample used here has 13 states, which is more than the analyses used in their paper which had 2 and 4 groups. Robust standard errors with 10 groups perform well in Hansen's (2007) simulations. Second, the owners of the restaurants for which data was used in this paper have individual control over wages, employment, and most other aspects of their business, working to mitigate the concerns about common effects within a state or across the chain which would overstate the precision of the estimates.

5 Results

In the following sub-sections, I present the results for estimating the impact of changes in the minimum wage on the four channels of adjustment. The first sub-section considers how minimum wages impact employees. The next two sub-sections examine how minimum wages impact customers and owners, respectively. The last sub-section then examines how minimum wages affect each restaurant's production decisions.

5.1 Employees

The employment channel is the one most commonly studied in the literature. The results presented in this section therefore serve as both a replication of those results, and a calibration of this analysis. Table 4 presents those results. The first two columns of the table presents the results using the natural log of the average hourly wage at each restaurant as the dependent variable. Columns 3 and 4 use the natural log of the number of workers at each restaurant as the dependent variable and the last two columns use the natural log of the total hours worked at each restaurant. The odd-numbered columns show the results using the wage gap measure for each minimum wage change, whereas the even numbered columns combine the minimum wage changes into one large treatment.

Column 1 of Table 4 shows that restaurants with larger wage gaps experience a larger increase in the hourly wage after the minimum wage change, but the effect is not statistically significant. Column 2 considers the combined minimum wage effect and finds that minimum wage increasss do result in higher wages for workers. Columns 3 and 4 of Table 4 consider the impact on overall employment at each restaurant and finds negative effects, but only marginally significant in column 3. The last two columns show the impact of the minimum wage gap on total hours worked. In both columns 5 and 6, the impact of the wage gap is negative and statistically significant. The coefficient in column 6 of -3.438 indicates that restaurants with a 1% larger wage gap reduce their total hours worked by 3% more than do

other restaurants.

Overall, the results of Table 4 show evidence that minimum wage increases result in higher wages for workers, but fewer hours worked. However, there is not strong evidence that employment is reduced in response to higher minimum wages.

Table 5 shows the results of specifications examining the impact of minimum wages on other employment outcomes, namely total labor costs, average worker age, percent of workforce that is male, employment turnover, average worker tenure, and average hours worked. The top panel displays the results for each minimum wage change, whereas the bottom panel examines the combined minimum wage treatment. Table 5 does not reveal a striking effect of minimum wage changes on these outcomes, though there may be a slight increase in prevalence of male workers in the short-run, and a decrease in average worker tenure in the long run.

The first column of both panels in Table 5 show the impact of minimum wages on total labor costs, which includes both total wages paid and all employee benefits provided. This measure is the total for each store in that quarter. The results in column 1 do not reveal a statistically significant effect on total wages paid, suggesting that any increases in wages are offset by reduced hours. In Section 6 below, I discuss how these estimates are useful for determining how much employees help pay for the increased minimum wage.

Overall, the results discussed in this section are consistent with the literature, that minimum wages increase wages for the workers most impacted, have no impact on overall employment, but do reduce the total hours worked at each restaurant.

5.2 Customers

The next potential payee of minimum wage increases are the customers. Customers could pay for higher minimum wages through higher prices, lower product quality, or lower customer service. The data does not provide a direct measure of product quality, but should be captured in the various measures of customer satisfaction provided in the data. Table

6 shows the results for prices and customer demand. Table A1 in the appendix shows the results for various measures of customer satisfaction.

It is important to note that individual store owners do not have complete control over product prices. Product prices are jointly determined by the owners within a particular market and the corporate headquarters. It is also the case that the headquarters monitors minimum wage increases and determines whether or not the minimum wage increase was large enough to merit an increase in product prices. Headquarters does not have a strict rule which determines when prices can or can not be raised in response to minimum wage increases. Instead, the minimum wage increase acts like a shock for both the store owners and headquarters to re-evaluate all the factors which influence output prices, and then determine whether prices should be raised.

The first two columns of Table 6 show the impact of minimum wages on how much stores increase their output prices. The dependent variable is the percent change in the output price index. In the sample, when stores change their output prices, the price index increases by 3% on average. The result in columns 1 and 2 show that stores with larger wage gaps increase their prices more in response to increases in the minimum wage.

These results suggest that customers help pay for higher minimum wages by paying more for their food. However, if customers follow the law of demand, they would reduce their demand for the output in response to the higher prices. Columns 3 and 4 of Table 6 investigate the intensive margin of this response on the part of the customers by analyzing whether minimum wages affect the average transaction price at each store. The average transaction price is calculated by dividing total revenue by the number of transactions at each store.[4] The results in columns 3 and 4 are not statistically significant. Columns 5 and 6 then analyze the extensive margin of consumer demand, showing the impact of minimum wages on the number of transactions at each store. The result in column 6 indicates that consumers do reduce their demand more in restaurants with larger wage gaps.

[4]The average transaction price over the whole sample is $6.95.

Table A1 shows the results for whether minimum wages affect customer satisfaction. There are five measures of customer satisfaction, which are collected from consumer surveys. The five measures are "Overall", "Taste", "Speed", "Service", and "Cleanliness". The values reported are the percent of respondents who reported a score of "Excellent" on the survey in each quarter. The "Overall" value is the percent of customers who reported a score of "Excellent" for all four of the other categories. The results on customer satisfaction do not show any significant effects of minimum wages on product quality or customer service.

5.3 Owners

This sub-section analyzes to what extent operating profits of store owners are affected by changes in the minimum wage. Table 7 shows the results of specifications analyzing the impact of minimum wage changes on restaurant operating profits and total sales. The odd-numbered columns indicate that each individual minimum wage change does not have a statistically significant impact on total sales or operating profits in the short-run. However, the even-numbered columns of Table 7 reveal the combined minimum wage treatment has a negative and statistically significant effect on both total sales and operating profits. The results on the control variables follow standard intuition, that more experienced owners are able to generate more profit and that stores in states with high unemployment rates have lower profits.

To the best of my knowledge, this is the first time restaurant level operating profit data has been used to examine the impact of minimum wages on profits.

5.4 Production Function

The last category of ways companies can respond to increases in the minimum wage relate to the production function. Stores could offset some of the increased costs due to minimum wages by increasing their productivity or by reducing other input costs. The results examining these possible responses are presented in Table 8. The top panel shows

the results for each minimum wage change, whereas the bottom panel examines the impact of the combined minimum wage treatment.

These restaurants do some catering business and the first column of the bottom panel of Table 8 shows minimum wages significantly reduce how much revenue restaurants generate from outside catering. Column 2 in both panels of Table 8 finds no effect of minimum wages on the number of transactions per employee at each restaurant.. Column 3 shows the results for the impact on sales generated for each hour worked. Column 3 in the bottom panel indicates that minimum wage changes increase the sales per hour worked, which could be driven by the reduced number of total hours worked shown in Table 4 above.

Another way stores could increase productivity, and thus help offset increased labor costs, is by "running a tighter ship". The headquarters of this restaurant chain provides two operating targets to each restaurant, one for labor hours and one for food costs. The details for how these targets were set for each restaurant were not provided. I used these targets to create a measure of tightness by subtracting the target from the actual value, and then taking the absolute value of the difference. The results of these analyses on tightness are presented in the last two columns of Table 8, and show no significant impact of minimum wages on how closely store owners track operational targets.

Another way stores could offset increased labor costs is through reducing the costs of other inputs into the production function. The impact of minimum wages on other input costs are shown in Table A2 in the appendix. Paper costs measure how much stores spend on paper products, such as cups, napkins, etc. Discounts measure the food and paper costs of transactions discounted at the point-of-sale. The last three categories are cleaning, utility, and kitchen expenses.

If restaurants are cutting corners on other inputs into their production function in response to minimum wage increases, we should see negative results reported in Table A2. The first column indicates that restaurants are spending less on paper products in response to minimum wage increases. However, this result is most likely due to the lower number of

transactions reported in Table 6. The bottom panel of column 2 also indicates that stores use less discounting in response to minimum wage increases. The last three columns show no significant effect on cleaning, utility, and kitchen expenses. Overall, the results reported in Table A2 show reduced paper costs and reduced use of discounts, but no other evidence of stores cutting corners on other inputs to help offset increased labor costs.

6 Incidence of the Minimum Wage

One of the contributions of this paper is its ability to compare multiple channels of adjustment by each store in attempt to answer the question, "How do restaurants pay for the minimum wage?". The first step in answering this question is determining how much minimum wages cost. This is harder then it seems at first glance as its not clear how much wages should increase for workers already earning above the minimum wage. Legally, workers who have been earning more then the new minimum wage are not required to receive a raise. However, those workers may have more seniority or be more productive then their co-workers who just received a government mandated pay raise. If the high wage workers don't receive a raise, they may become disgruntled and not work as hard as before. Restaurant owners know this, and often provide pay raises to workers earning above the new minimum wage in order to maintain an optimal wage distribution within each restaurant. Unfortunately, the optimal wage distribution is restaurant specific, may change along with the minimum wage change, and is unknown to outside researchers. In this section I propose bounds for the true cost of a minimum wage change, and also consider evidence from previous research on how minimum wages affect the wage distribution. I then calculate how much each adjustment channel helps pay for the minimum wage based on these various hypothetical changes in the wage distribution for each restaurant.

For the lower bound, the smallest possible cost of the minimum wage is the least amount stores would have to increase their wages to comply with the new minimum wage law. This

is exactly what "Wage Gap" measures. In this sample, the average wage gap for stores facing an increase in the minimum wage is 0.53% for each minimum wage change and 2.77% for the combined minimum wage change. For the upper bound, the most that stores could raise their wages in response to an increase in the minimum wage is if they raised every workers' wage by the same percentage as the increase in the minimum wage, thereby preserving the same wage distribution as existed previously. In this sample, the average increase in the minimum wage is 10% for each minimum wage change and 32.2% for the combined minimum wage change. These statistics imply that stores would increase their total wage bill by 10% and 32.2% respectively . Recent research provides some insight for how minimum wages affect the wage distribution (Neumark, Schweitzer and Wascher, 2004; Dube, Giuliano and Leonard, 2015; Hirsch, Kaufman and Zelenska, 2015; Phelan, 2016).

Even though Dube, Giuliano, and Leonard (DGL) (2015) study the effect of unequal raises on quit behavior, which is not directly related to this paper, they provide the actual formula used by the company in their study to provide raises to workers in response to changes in the minimum wage. While that formula was designed for the specific changes in the minimum wage the company was responding to, I adopt the same goal of raising wages for workers earning up to 15% above the new minimum wage. In DGL, the raise schedule was a stair-step pattern with the biggest raise going to workers earning the old minimum wage, all the way up to workers earning 15% above the new minimum wage. I apply that same strategy to all minimum wage changes observed in the data used for this study, and also linearize the formula for computational ease. My adaptation of the DGL formula is calculated as:

$$DGL_{jt} = \frac{\int_{MW_{jt-1}}^{1.15*MW_{jt}} \Big[Max[MW_{jt} - x + \psi(x - MW_{jt-1}), 0] * H_{jt} * f(x) \Big] dx}{E_{jt}}, \qquad (4)$$

where $\psi = \frac{1.15*MW_{jt} - MW_{jt}}{1.15*MW_{jt} - MW_{jt-1}}$, the slope of the line going from the bottom step of the raise

ladder to the top. When applying this adapted raise formula to my data, I find the average total cost of the minimum wage to be 2.64%.

Hirsch, Kaufman, and Zelenska (2015) also examine the extent of spillovers found in their data. They found positive but insignificant effects of the wage gap on wages of workers above the new minimum wage. Therefore I do not use their findings in this analysis.

Neumark, Schweitzer, and Wascher (NSW) (2004) study how minimum wages effect the overall wage distribution nationally. They find significant and positive effects for workers earning up to 3 times greater than the new minimum wage. I apply their findings to these restaurants according to the following table:

Wage	% Raise
w < MW - \$0.10	1.39
MW - \$0.10 ≤ w ≤ MW + \$0.10	0.79
MW + \$0.10 < w ≤ 1.1 * MW	0.78
1.1 < w/MW ≤ 1.2	0.41
1.2 < w/MW ≤ 1.3	0.36
1.3 < w/MW ≤ 1.5	0.26
1.5 < w/MW ≤ 2	0.16
2 < w/MW ≤ 3	0.06

Applying these spillover results to my data, I find the average total cost of the minimum wage to be 3.07%.

Phelan (2016) also analyzes the extent to which minimum wages cause spillovers. However, he examines spillovers across occupations and therefore does not provide a good estimate for the true cost of the minimum wage in the restaurants considered here.

Using both the bounds for the true cost of the minimum wage and the estimates found in DGL and NSW, I next use the estimates reported above to determine how much each channel of adjustment helps pay for. I start with the employment channel. If employees see their total wage bill increase by the full cost of the minimum wage increase, then employees have not paid for any of the increase. Instead, they have received the full benefit of the minimum wage increase. On the other hand, if employees see their total wage bill increase by less than the full cost of the minimum wage, they are helping pay for the minimum wage. So, the extent by which the total labor costs increase less than the full cost of the minimum

wage is the employee's share in paying for the minimum wage.

Gap_{jt} measures the minimum stores would have to increase their total labor costs to comply with the new minimum wage, but it assumes that workers do not change the number of hours they work. Stores could obviously reduce the number of hours worked by employees and thereby deflect some of the increases in total labor costs. However, the results above show a positive impact of minimum wages on total hours worked. Second, stores could make employees pay for the minimum wage increase by changing the composition of the workforce. Stores could substitute away from these high-wage workers and use more low wage workers, even though the low-wage workers wages increased. The results reported above, and the work of Giuliano (2013), support this mechanism.

The lower bound for the true cost of the minimum wage says that total labor costs should increase by 1.94%. However, Table 5 reports an elasticity for total labor costs with respect to the minimum wage of 0.146 in column 7. With the average minimum wage change in this sample being 9.9%, the estimated increase in total labor costs is 1.45%. This increase is smaller than the full cost of the minimum wage, indicating that workers do help pay for the minimum wage. The first row of column 1 Table 9 reports this result. The bottom panel of Table 9 use the estimate for the elasticity of total labor costs with respect to the wage gap to calculate the incidence of the minimum wage for employees. The point estimate is larger than that reported in row 1, however both estimates are not statistically significant.

Both of the estimates for the true cost of the minimum wage based on DGL and NSW's findings are larger than the lower bound. Therefore, when considering these scenarios, the estimates for how much employees pay for the minimum wage will be larger. These results are reported in columns 2 and 3 of Table 9. Again, the top panel reports estimates based on minimum wage elasticities, whereas the bottom panel reports estimates using wage gap elasticities. All four estimates are near 50%, and three of the four are statistically different from 0. These estimates suggest that in the restaurants studied here, employees total earnings do not increases as much as predicted by the findings of DGL and NSW, and therefore

employees help pay for about 50% of the minimum wage increase.

The result for the upper bound scenario are reported in column 4 of Table 9. If the minimum wage increased by 9.9%, then total labor costs should also have increased by 9.9%. Instead, the results from Table 5 indicate that total labor costs only increased by 1.45% when using the minimum wage treatment. This suggests that employees pay for $(1 - 1.45/9.9) = 85.4\%$ of the cost of the minimum wage. The bottom panel finds a similar estimate when using the wage gap treatment. Both estimates are statistically significant.

The second channel of adjustment is the customers. If the customers paid for the full cost of the minimum wage increase, total revenue at each store should increase by an amount equal to the increase in labor costs multiplied by labor's share in total costs. Again, labor's share in total costs is 36% in this sample. So, using the lower bound, total revenue would have had to increase by $1.94 * 0.36 = 0.70\%$ if customers paid for the full cost of the minimum wage. Based on the total revenue elasticties reported in Table 7, the estimates for how much customers helped pay for the minimum wage are reported in the second row of both panels in Table 9. The top panel reports positive incidences for customers, but the estimates are all less than 20% and are not statistically different from 0. The bottom panel reports both large and significant incidences for customers. The first three columns suggest that customers pay more than their fair share, with incidences greater than 1. These results suggest the company raises prices more than what was necessary to pay for the minimum wage.

The third channel is the store owner. If store owners paid for the full cost of the minimum wage, they would see their profits fall by an amount equal to the increase in labor costs multiplied by labor's share in total costs. In this sample, labor costs are 36% of total costs. So, using the lower bound, owners should see a fall in profit by $1.94 * 0.36 = 0.70\%$ if they paid for the full cost of the minimum wage. Instead, the results in Table 7 find no statistical impact of minimum wages on profits. The estimates for how much owners helped pay for the minimum wage are reported in the third row of each panel in Table 9. In both panels, the results are not significantly different from 0. The negative estimates shown in the bottom

panel suggest that the owners might benefit from the increased minimum wages, which makes sense given the results reported for the employee and customer channels. However, the results are not statistically significant.

The remaining channel of adjustment is the production function. While the results presented above showed that minimum wages did impact the production function, it is more difficult to then determine the value of these impacts. For example, Table **??** showed that minimum wages reduced employee turnover. We know that employee turnover is costly to stores, but it is harder to calculate how much money was saved by a 1.2% reduction in turnover. Therefore, I assign any cost of the minimum wage that wasn't paid for by the first three channels to be paid for by the production function. Then, the lower bound for the costs of the minimum wage indicates the production function paid for -37%, whereas the upper bound indicates the production function was able to pay for -5% of the costs. However, none of the estimates are statistically significant.

Overall, this section shows that in order to determine the incidence of the minimum wage, the true total cost of the minimum wage needs to be determined. This section considered four scenarios, a lower bound, an upper bound, and two results found in the literature (Neumark, Schweitzer and Wascher, 2004; Dube, Giuliano and Leonard, 2015). The results using the two scenarios found in the literature show that employees help pay for about 50% of the total cost of the minimum wage increase while customers help pay for over 100% of the increased costs. Both restaurant owners and the production function were not found to help pay for the increased costs.

7 Conclusion

This project analyzed how stores in a national restaurant chain are impacted by changes in the minimum wage. The study makes use of a unique dataset with quarterly financial data on over 500 restaurants in 13 states for the years 2006-2010. During this time, about

half of the states implemented minimum wages that were above the national minimum wage, and the other half of the states saw their minimum wage increase as the federal minimum increased from $5.15 in 2006 to $7.25 in 2010.

The empirical analysis used measures of the wage gap at individual restaurants to identify the impact of minimum wage changes on four main channels of adjustment, employees, customers, owners, and the production function. The results found that overall average hourly wages increased in response to changes in the minimum wage, however the total hours worked at each store decreased.

The next section showed that customers are negatively impacted by minimum wage increases as they face higher prices for food. However, customers respond by making fewer transactions at each store. The analysis did not find strong evidence that customer satisfaction was negatively impacted by minimum wages. The analysis then found evidence that minimum wages negatively impacted operating profits using the combined minimum wage treatment. It is important to remember that the experiences of this restaurant chain may or may not generalize to other restaurants, or to larger increases in the minimum wage.

The last section of the analysis considered how components of the production function could be adjusted to help pay for the minimum wage. The results found mixed results on productivity, with the average sales per hour worked increasing slightly. There was also no evidence of restaurants cutting back on other inputs or increasing their operational efficiency.

A benefit of having such comprehensive data for each store was the ability to explore many avenues of adjustment. However, as seen in the results presented above, many of those avenues of adjustment were not found to be statistically significant. This is not surprising for two reasons. First, it could be that each store was running efficiently before the minimum wage change, and there was no more room to reduce costs along these other dimensions after the minimum wage change. Second, the results above also showed that the minimum wage increases had relatively small impacts on overall wage costs.

Many of the significant results above were found by using the combined wage gap treat-

ment. That treatment has extra power because the larger treatment value and longer duration available to identify respnsones. However, the restaurant level variation in wage gap could be due to two different situations. One, it could be that restaurants with high wage gaps have owners who are very stringent, and work hard to minimize costs as much as possible. However, it could also be that restaurants with high wage gaps are located in communities with low wages. The data just identifies the state each restaurant is located in, so the above specifications are able to control for state-specific factors, but not the local wage level. It would be useful to know more about local wage levels in order to analyze the various mechanisms by which wage gaps impact restaurants.

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Figure 1: Trends in Outcomes by Restaurant Type, 2006-2010

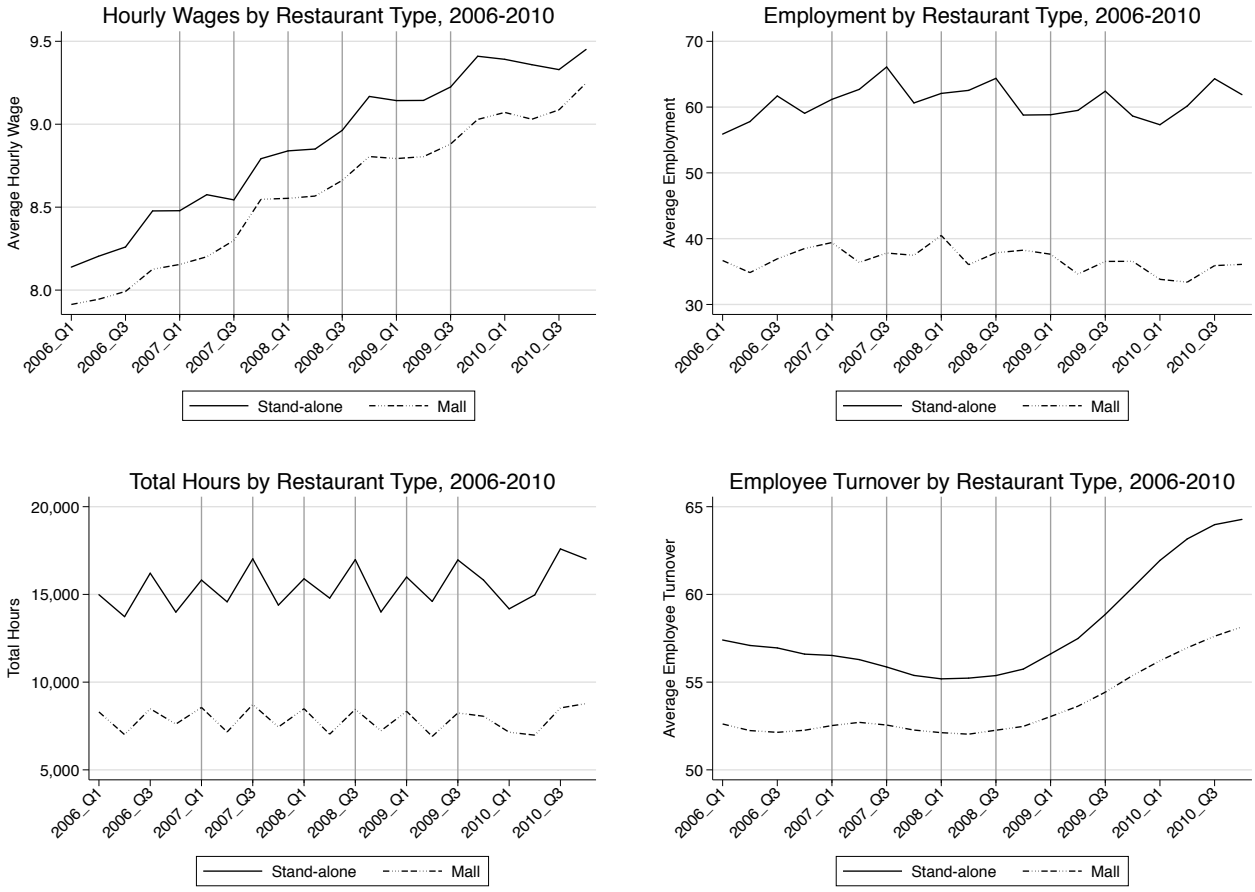

Table 1: Restaurant Level Summary Statistics, 2006-2010

	Stand Alone Restaurants		Mall Restaurants	
	(1)	(2)	(3)	(4)
	mean	sd	mean	sd
(Profits / Total Sales)	36.0	(4.1)	35.0	(5.4)
(Wage Costs / Total Costs)	31.2	(1.9)	31.6	(2.2)
(Food Costs / Total Costs)	44.1	(2.5)	43.7	(2.8)
(Paper Costs / Total Costs)	7.1	(0.6)	7.3	(0.7)
(Other Employment Costs / Total Costs)	4.4	(0.7)	5.0	(1.0)
Percent of Sales from Catering	2.7	(2.8)	4.6	(5.5)
Restaurant Age (quarters)	28.1	(20.1)	84.0	(36.3)
Tenure of Rest. Owner (quarters)	22.1	(17.2)	27.1	(30.8)
Total Rest. Employment	60.6	(16.5)	36.6	(12.2)
Total Hours Worked	15,524	(3,957)	7,873	(2,341)
Percent Male	0.4	(0.1)	0.4	(0.1)
Average Employee Tenure (quarters)	1.9	(1.0)	1.9	(1.2)
Hourly Wage Rate	9.46	(0.86)	9.07	(0.95)
Average Hours Worked Each Week	20.2	(4.1)	17.2	(4.2)
Number of Restaurants	409		106	
Number of Obs.	6,891		2,084	

Table 2: Changes in the Minimum Wage Between 2006-2010 by State

Year	Quarter	High MW States [CA, CO, FL, MD, NC, OH, PA] (1)	Federal MW States [AL, GA, SC, TN, TX, VA] (2)
2007	1	0.76	0
2007	3	0.09	0.70
2008	1	0.10	0
2008	3	0.14	0.70
2009	1	0.17	0
2009	3	0.27	0.70
Num. of Restaurants		236	279

Notes: "High MW States" are states that had minimum wages above the federal minimum in 2007. The change in the minimum wage reported for "High MW States" is the average change across the states, weighted by the number of restaurants in each state. By 2009Q3, only California, Colorado, and Ohio had minimum wages above the federal minimum.

Table 3: Estimated Impact of Minimum Wage Changes on Restaurants

Year	Quarter	Wage Gap (1)	Percent of Hours Worked Below New MW (2)	Number of Restaurants Impacted (3)
2007	1	1.007	9.7	163
2007	3	1.004	3.6	251
2008	1	1.002	0.4	104
2008	3	1.005	7.7	318
2009	1	1.004	9.7	94
2009	3	1.007	12.3	425
Combined MW Change		1.028	28.3	471

Notes: "Wage Gap" measures the percent change in wages that would have to occur to bring every worker's wage up to the new minimum wage. "Percent Below" measures the percent of worker-hours that are estimated to be below the new minimum wage.

Table 4: Event Study Impact of Minimum Wage Changes on Restaurant Wages, Employment and Total Hours, 2006-2010

	ln(Hourly Wage)		ln(Employment)		ln(Total Hours)	
	(1)	(2)	(3)	(4)	(5)	(6)
	Each ΔMW	One ΔMW	Each ΔMW	One ΔMW	Each ΔMW	One ΔMW
ln(Wage Gap) * After	0.312	1.061***	-1.218*	-1.441	-0.987*	-3.438**
	(0.229)	(0.245)	(0.643)	(1.000)	(0.473)	(1.172)
After MW Change	0.018***	0.045**	0.012	-0.131**	0.061***	0.207*
	(0.003)	(0.018)	(0.009)	(0.059)	(0.010)	(0.104)
Owner Tenure	0.001	0.001	-0.003***	-0.001	0.001	0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
ln(Population)	0.449**	0.259	1.274**	2.156*	0.761	0.712
	(0.163)	(0.280)	(0.542)	(1.023)	(0.646)	(1.140)
Unemp. Rate	-0.002	0.002	-0.009	0.009	-0.016**	-0.014
	(0.003)	(0.002)	(0.006)	(0.008)	(0.007)	(0.014)
Constant	-5.109*	-2.044	-16.553*	-30.900*	-2.877	-2.067
	(2.635)	(4.516)	(8.777)	(16.540)	(10.482)	(18.446)
Adj. R^2	0.859	0.791	0.844	0.815	0.897	0.762
Observations	2737	941	2737	941	2737	941

Notes: All specifications include period and restaurant fixed effects. Robust standard errors are clustered at the state level.

Table 5: Event Study Impact of Minimum Wage Changes on Other Employment Outcomes, 2006-2010

	Tot Labor Costs	Avg. Age	Percent Male	Turnver	Avg. Tenure	Avg. Hours
	(1)	(2)	(3)	(4)	(5)	(6)
	Each Minimum Wage Change					
ln(Wage Gap) * After	-1.061	-0.055	0.499**	-0.267	0.115	-1.850
	(0.633)	(0.208)	(0.195)	(0.435)	(1.702)	(1.526)
After MW Change	0.049***	-0.001	0.000	0.013**	0.059***	0.058*
	(0.008)	(0.002)	(0.002)	(0.006)	(0.018)	(0.032)
Owner Tenure	0.002	0.000	-0.001	0.002***	0.036***	0.012***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.006)	(0.002)
ln(Population)	1.474**	0.367***	-0.099	-1.128**	-1.357	-0.638
	(0.558)	(0.101)	(0.174)	(0.437)	(0.818)	(1.173)
Unemp. Rate	-0.012*	0.003	0.001	0.008	-0.021**	-0.018
	(0.006)	(0.002)	(0.002)	(0.005)	(0.008)	(0.014)
$Adj.R^2$	0.946	0.836	0.741	0.724	0.812	0.715
Number	2736	2737	2737	2415	2737	2723
	One Combined MW Change					
ln(Wage Gap) * After	-1.442	-0.079	0.080	-0.202	-3.677*	-1.638
	(0.957)	(0.172)	(0.362)	(0.663)	(1.902)	(1.414)
After MW Change	0.153*	0.004	-0.005	0.007	0.928***	0.635***
	(0.082)	(0.017)	(0.013)	(0.049)	(0.219)	(0.144)
Owner Tenure	0.002	0.001**	-0.000	0.003*	0.032***	0.008**
	(0.002)	(0.000)	(0.001)	(0.001)	(0.006)	(0.003)
ln(Population)	1.200	0.402**	-0.153	-0.771	-5.375*	-3.252
	(1.022)	(0.172)	(0.107)	(0.563)	(2.915)	(2.638)
Unemp. Rate	-0.004	0.004	0.004***	0.016*	-0.075**	-0.051*
	(0.012)	(0.002)	(0.001)	(0.008)	(0.032)	(0.025)
$Adj.R^2$	0.881	0.732	0.598	0.538	0.676	0.645
Number	940	941	941	795	941	940

Notes: All specifications include period and restaurant fixed effects. Robust standard errors are clustered at the state level.

Table 6: Event Study Impact of Minimum Wage Changes on Product Prices and Customer Demand, 2006-2010

	%Δ Prices		ln(Transaction Amnt)		ln(Num Transactions)	
	(1)	(2)	(3)	(4)	(5)	(6)
	Each ΔMW	One ΔMW	Each ΔMW	One ΔMW	Each ΔMW	One ΔMW
ln(Wage Gap) * After	0.818**	0.274***	-0.064	0.200	-0.892	-2.527**
	(0.311)	(0.070)	(0.230)	(0.254)	(0.529)	(0.953)
After MW Change	0.007	0.043	0.029***	0.056***	0.030***	0.181*
	(0.008)	(0.048)	(0.005)	(0.017)	(0.007)	(0.093)
Owner Tenure	0.000	-0.000**	0.001***	0.000	0.002**	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
ln(Population)	-0.450**	0.677	0.317	0.382	0.694	0.324
	(0.189)	(0.521)	(0.209)	(0.400)	(0.518)	(0.994)
Unemp. Rate	-0.006*	0.005	-0.003	0.004**	-0.011**	-0.014
	(0.003)	(0.005)	(0.003)	(0.001)	(0.005)	(0.012)
Constant	8.325**	-9.838	-3.289	-4.333	0.129	6.125
	(3.060)	(8.377)	(3.381)	(6.467)	(8.402)	(16.086)
Adj. R^2	0.096	0.916	0.960	0.935	0.936	0.859
Observations	2708	482	2736	940	2736	940

Notes: All specifications include period and restaurant fixed effects. Robust standard errors are clustered at the state level.

Table 7: Event Study Impact of Minimum Wage Changes on Total Sales and Operating Profits, 2006-2010

	ln(Total Sales)		ln(Operating Profits)	
	(1)	(2)	(3)	(4)
	Each MW	Big MW	Each MW	Big MW
ln(Wage Gap) * After	-0.904	-2.316**	-0.589	-2.593*
	(0.636)	(0.952)	(0.899)	(1.227)
After MW Change	0.059***	0.246**	0.082***	0.429***
	(0.009)	(0.089)	(0.019)	(0.103)
Owner Tenure	0.002***	0.002	0.003***	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
ln(Population)	0.974*	0.624	-0.058	-0.300
	(0.520)	(1.010)	(0.956)	(1.141)
Unemp. Rate	-0.015**	-0.012	-0.023***	-0.034**
	(0.005)	(0.012)	(0.007)	(0.013)
Constant	-2.560	3.128	13.104	17.108
	(8.421)	(16.344)	(15.480)	(18.461)
Adj. R^2	0.948	0.893	0.920	0.866
Observations	2736	940	2736	940

Notes: Operating profit calculations exclude data on occupancy costs, credit card fees, and franchise fees. All specifications include period and restaurant fixed effects. Robust standard errors are clustered at the state level. The time period is a quarter.

Table 8: Event Study Impact of Minimum Wage Changes on Restaurant Productivity, 2006-2010

	Per. Catering	Trans/Employee	Sales/Hour Worked	Hours Target	Food Target
	(1)	(2)	(3)	(4)	(5)
	Each Minimum Wage Change				
ln(Wage Gap) * After	-3.079	0.291	0.321	0.012	-6.602
	(4.668)	(0.605)	(0.429)	(2.074)	(4.294)
After MW Change	0.178	0.022*	0.001	-0.002	0.050
	(0.101)	(0.011)	(0.009)	(0.070)	(0.054)
Owner Tenure	0.044***	0.004***	0.001	-0.002	0.001
	(0.011)	(0.001)	(0.001)	(0.004)	(0.003)
ln(Population)	-12.978*	-0.597	0.356	0.477	2.577
	(6.520)	(0.648)	(0.455)	(3.064)	(2.178)
Unemp. Rate	-0.148*	-0.003	-0.002	0.030	-0.012
	(0.071)	(0.005)	(0.004)	(0.035)	(0.032)
$Adj.R^2$	0.854	0.682	0.625	0.488	0.425
Number	2736	2736	2736	2736	2736
	One Combined MW Change				
ln(Wage Gap) * After	-13.808*	-1.195	0.812*	-1.712	-0.842
	(7.587)	(1.105)	(0.396)	(4.524)	(3.252)
After MW Change	0.794	0.332***	0.034	-0.790***	-0.105
	(0.751)	(0.107)	(0.033)	(0.246)	(0.281)
Owner Tenure	0.030*	0.002*	0.001	-0.002	-0.001
	(0.015)	(0.001)	(0.001)	(0.003)	(0.004)
ln(Population)	-11.494	-1.906	0.362	3.950*	0.426
	(14.365)	(1.297)	(0.391)	(1.855)	(3.532)
Unemp. Rate	-0.071	-0.026*	0.003	0.124***	-0.009
	(0.119)	(0.012)	(0.005)	(0.020)	(0.044)
$Adj.R^2$	0.740	0.605	0.558	0.292	0.347
Number	940	940	940	940	940

Notes: All specifications include period and restaurant fixed effects. Robust standard errors are clustered at the state level. The time period is a quarter.

Table 9: Summary of Minimum Wage Accounting

Category	Lower Bound (1)	Dube, Giuliano, and Leonard (2)	Neumark, Schweitzer, and Wascher (3)	Upper Bound (4)
Each Minimum Wage Change				
Employees	2.061	1.213	1.184	1.056
	(0.575)	(0.116)	(0.100)	(0.031)
Customers	-2.519	-0.507	-0.436	-0.134
	(1.607)	(0.323)	(0.278)	(0.085)
Owners	1.642	0.330	0.284	0.087
	(2.274)	(0.458)	(0.394)	(0.121)
Production Fcn.	-0.184	-0.037	-0.032	-0.010
	(1.192)	(0.240)	(0.206)	(0.063)
One Combined MW Change				
Employees	2.152	2.208	2.040	1.099
	(0.639)	(0.670)	(0.577)	(0.055)
Customers	-4.701	-4.931	-4.245	-0.405
	(1.534)	(1.609)	(1.385)	(0.132)
Owners	4.749	4.981	4.288	0.409
	(1.722)	(1.806)	(1.555)	(0.148)
Production Fcn.	-1.199	-1.258	-1.083	-0.103
	(0.928)	(0.974)	(0.838)	(0.080)

Notes: Standard errors are in parentheses. Results report the share of costs that are paid for by each category.

A Appendix: Extra Results Tables

Table A1: Impact of Minimum Wage on Customer Satisfaction, 2006-2010

	Overall	Taste	Speed	Service	Cleanliness
	(1)	(2)	(3)	(4)	(5)
	Each Minimum Wage Change				
ln(Wage Gap) * After	34.744	15.106	36.987	39.570	26.297
	(21.185)	(21.437)	(23.131)	(22.665)	(23.202)
After MW Change	1.010***	1.089***	0.742**	0.653*	0.792***
	(0.300)	(0.245)	(0.245)	(0.364)	(0.253)
Owner Tenure	0.045	0.039	0.056	0.031	0.025
	(0.035)	(0.033)	(0.036)	(0.038)	(0.029)
ln(Population)	-40.857*	-36.121**	-38.779**	-32.571**	-15.964
	(18.783)	(13.516)	(15.066)	(13.463)	(10.030)
Unemp. Rate	0.439**	0.220	0.227	0.430*	0.296
	(0.197)	(0.124)	(0.152)	(0.222)	(0.202)
Constant	705.733**	651.836**	690.915**	596.553**	323.180*
	(303.837)	(218.556)	(243.477)	(217.634)	(162.097)
$Adj.R^2$	0.695	0.611	0.672	0.693	0.742
Number	2689	2689	2689	2689	2689
	One Combined MW Change				
ln(Wage Gap) * After	28.087	6.673	34.823	34.444	12.146
	(30.616)	(18.507)	(30.183)	(39.189)	(27.517)
After MW Change	1.038	1.400	0.869	-0.952	-1.329
	(2.110)	(1.792)	(1.936)	(1.877)	(1.494)
Owner Tenure	0.029	0.031	0.042	0.027	0.004
	(0.030)	(0.026)	(0.045)	(0.028)	(0.029)
ln(Population)	-14.029	-13.705	-25.484	-39.671	5.485
	(24.714)	(22.725)	(27.598)	(34.902)	(24.857)
Unemp. Rate	1.299***	0.850**	0.913**	0.978**	1.098***
	(0.299)	(0.287)	(0.305)	(0.351)	(0.257)
Constant	268.203	286.644	472.848	708.999	-26.489
	(398.504)	(366.640)	(445.169)	(563.323)	(401.057)
$Adj.R^2$	0.727	0.670	0.666	0.646	0.716
Number	894	894	894	894	894

Notes: All specifications include period and restaurant fixed effects. Robust standard errors are clustered at the state level. The time period is a quarter.

Table A2: Impact of Minimum Wage on Other Costs, 2006-2010

	Paper Costs	Discounts	Cleaning	Utilities	Kitchen
	(1)	(2)	(3)	(4)	(5)
	Each Minimum Wage Change				
ln(Wage Gap) * After	-1.550**	-1.587	-0.869	0.013	-0.564
	(0.629)	(2.216)	(1.361)	(0.960)	(2.252)
After MW Change	0.042***	-0.016	0.035*	0.072**	0.059**
	(0.010)	(0.050)	(0.018)	(0.027)	(0.021)
Owner Tenure	0.002**	0.007**	-0.000	-0.001	-0.006***
	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)
ln(Population)	1.313**	5.239*	0.717	0.618	1.246
	(0.552)	(2.767)	(0.968)	(0.945)	(0.946)
Unemp. Rate	-0.010*	0.011	0.010	0.000	0.028**
	(0.006)	(0.027)	(0.007)	(0.007)	(0.010)
$Adj.R^2$	0.944	0.748	0.913	0.879	0.736
Number	2736	2735	2736	2736	2736
	One Combined MW Change				
ln(Wage Gap) * After	-2.686**	-5.581***	-0.867	-1.603	-0.040
	(0.897)	(1.798)	(1.686)	(0.906)	(1.526)
After MW Change	0.213**	-0.123	0.013	0.282**	-0.002
	(0.094)	(0.128)	(0.082)	(0.115)	(0.103)
Owner Tenure	0.002	0.005*	-0.000	-0.000	-0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ln(Population)	0.780	2.671	1.163	-0.329	3.575**
	(0.946)	(1.940)	(1.770)	(0.925)	(1.410)
Unemp. Rate	-0.012	0.032**	0.017	-0.013	0.058***
	(0.012)	(0.014)	(0.011)	(0.021)	(0.012)
$Adj.R^2$	0.879	0.741	0.870	0.787	0.703
Number	940	940	940	940	940

Notes: All specifications include period and Restaurant fixed effects. Robust standard errors are clustered at the state level. The time period is a quarter.