Output Prices and the Minimum Wage

by Daniel Aaronson
and Eric French

June 2006
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Daniel Aaronson and Eric French are economists in Chicago. Their research in labor, health, and urban economics has appeared in a variety of journals, including The Review of Economic Studies, The Review of Economics and Statistics, the Journal of Labor Economics, the Journal of Human Resources, the Journal of Urban Economics, and the Journal of Applied Econometrics. Aaronson received a B.A. in economics from Washington University in St. Louis and a Ph.D. in economics from Northwestern University. French received a B.A. in economics from the University of California, Berkeley, and M.S. and Ph.D. degrees in economics from the University of Wisconsin–Madison.
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Executive Summary

Most economists believe that an increase in the minimum wage causes higher prices and lower employment. This belief rests partly on empirical evidence, but also on the view that labor markets are competitive; if markets are competitive, then increases in the minimum wage should both raise prices and reduce employment. However, a number of studies in the last decade have challenged these beliefs. Some of these studies have argued that the market for low-skilled labor has special characteristics that undermine the traditional economic consensus. They claim that the market for low-skilled labor isn’t competitive and employers have the power to set wages. As a result, an increase in the minimum wage will not necessarily lead to employment loss.

To test this claim, Daniel Aaronson and Eric French examined government-collected price data. In a series of studies over the last four years, Aaronson and French show that a 10 percent hike in the minimum wage increased restaurant prices on the whole by 0.7 percent, and prices at limited service establishments by 1.6 percent. This result, in combination with other information about the restaurant industry, can be used within a formal model of the labor market to infer the impact of a minimum wage increase on employment. They find that employment losses of 2 to 2.5 percent following a 10 percent increase in the minimum wage would be consistent with their estimated price responses. These findings are consistent with a competitive model but generally not consistent with imperfect competition models where individual restaurants have wage-setting power. This paper summarizes Aaronson and French’s results.

Monopsony and the Low-Wage Labor Market

Beginning in the early 1990’s, research by economists David Card and Alan Krueger sparked a debate regarding the employment effects of minimum wage increases. In a series of papers, these authors found that increasing the minimum wage has no—or even a small positive—effect on employment. In explanation of these surprising findings, the authors theorized that there were special characteristics of the low-skilled labor market that allowed employers to obtain monopsony power—a situation in which they would be able to set wages in the overall labor market. Since Stigler (1946), it has been known that under monopsony power, an increase in the minimum wage could increase employment. By contrast, if local labor markets are competitive, it is expected under general conditions, that an increase in the minimum wage will cause employment to decrease and prices to rise.

Since the original Card and Krueger research, many studies have reestimated the impact of minimum wage increases on employment, with most finding some evidence of disemployment, although the magnitude of these effects remains somewhat contentious.

Tracking price responses rather than employment responses offers an alternative method of measuring the market structure of low wage labor markets. Changes in the size of the workforce have a direct impact on output—increases in the workforce lead to more output,
while decreases lead to less output. When output increases as a result of increased labor, prices will fall. The reverse is also true—lower output from a smaller workforce leads to higher prices. Thus price responses can be used to infer the competitive nature of the labor market.

**Price Responses to Minimum Wage Increases**

Using a variety of government and private datasets, Aaronson and French show that prices do in fact rise in response to a minimum wage increase. Aaronson (2001) finds that minimum wage increases tend to raise prices. The magnitude and timing of these price increases is striking. Within three months of a wage hike, Aaronson finds that a 10 percent increase in the minimum wage resulted in a 0.4–0.7 percent increase in restaurant prices. Much of the increase occurred within the first month of the wage hike. In the fast food sector, prices rise 1.5 percent in response to a 10 percent increase.

Aaronson, French, and MacDonald (2004) utilize store-level Consumer Price Index (CPI) data generated by the United States Bureau of Labor Statistics (BLS) to separate firms by their relative use of low-skill, entry-level employment. A wage hike will particularly affect those firms employing a higher percentage of teenagers and other low-skilled employees. Using this new data, the authors find further evidence that prices rise following a wage hike. Tellingly, they also find that in areas where a greater number of employees earned the minimum wage, the price increases are larger than the overall results.

**Employment Effects of a Minimum Wage Increase**

Utilizing these price responses, along with other information about the restaurant industry such as labor’s share of costs and the demand elasticity for restaurant services, Aaronson and French (2003) construct a formal model to indirectly pin down the employment response to a minimum wage increase. In a perfectly competitive labor market, the authors find that a 10 percent increase in the minimum wage will result in a 2.5 to 3.5 percent decrease in employment. When the authors augment that model to allow for the possibility that employers have monopsony power, they find a calibrated employment response that is only slightly smaller (2 to 2.5 percent) than the perfect competition case. These results suggest that restaurant labor markets are generally consistent with competitive conditions but not with the monopsony model.

**Conclusion**

Although recent research has sparked intense interest in the role of imperfect competition in low-wage labor markets, Aaronson and French’s result that higher labor costs from minimum wage increases are pushed on to consumers in the form of higher prices is consistent with the competitive model, but not the monopsony model. Therefore, their results should temper interest in monopsony models as an explanation for small disemployment effects of the minimum wage.
I. Introduction

Over the last dozen years, research measuring how minimum wage increases affect employment has been reinvigorated by the compelling work of Card and Krueger (e.g., 1995). Until their research began appearing in the early 1990’s, economists generally believed that standard models of perfect competition were fairly accurate representations of low-wage labor markets. The estimates in the literature, summarized in a literature review by Brown et al. (1982), indicated that a 10 percent increase in the minimum wage would lower employment by 1 to 3 percent, depending upon the study. Although the lower bound of that range suggests quite a small disemployment impact, there seemed a consensus that increased minimum wages reduce employment.

Card and Krueger threw a wrench into this view, suggesting in a series of papers that an increase in the minimum wage has no—or perhaps even a small positive—effect on employment. Moreover, they discuss a number of facts, such as the prevalence of posted vacancies, which are inconsistent with competitive markets but consistent with models in which firms have monopsony power in the labor market. By monopsony, we mean that rather than simply pay the wage that prevails in the market, individual firms have wage-setting power. In other words, if firms were to cut their wages, employers would lose some, but not all, of their workers.

The traditional monopsony model is of a company that is the sole buyer of a good, in this case, of low-skilled labor. Stigler (1946) showed that increases in the minimum wage can increase employment if an employer has such buying power in the labor market, although he was skeptical that such a case was empirically important. We describe this argument in the next section. While low-wage labor markets are clearly not characterized by this pure monopsony situation, the small employment effects found in the empirical studies of Card and Krueger, and subsequently others, motivated a line of theoretical research that offered models in which multiple firms act in monopsony-like fashion. These include models in which transportation (Bhaskar and To, 1999) or employee search (Burdett and Mortenson, 1998) is costly and employers are not able to discriminate between high and low reservation wage workers. In both models, the firm would not lose all of its workers if it lowered the offered wage. Efficiency wage models (such as Manning, 1995; Rebitzer and Taylor, 1995) can also cause monopsony-like behavior. The empirical and theoretical evidence for such models is detailed in Manning (2003).

Partly in response to Card and Krueger, a slew of papers returned to the measurement of the employment response to movements in the minimum wage. Many, most prominently Neumark and Wascher (1996, 2000), find an effect in line with the earlier literature. Others find even larger negative effects (e.g., Deere et al., 1995; Kim and Taylor, 1995; Burkhauser et al., 2000) or no effect at all (e.g., Wellington, 1991; Dickens et al., 1999; Card and Krueger, 2000). This confusion is particularly acute since many of these papers use the same source of variation to identify the employment elasticity (albeit often from different time periods or geographic areas): the co-movement of teenage employment and the minimum wage. The diversity of results led one prominent observer to note, “[Card and Krueger’s] lasting contribution may well be to show that we just don’t know how many jobs would be lost if the minimum wage were increased ... and that we are unlikely to find out by using more sophisticated methods of inference on the existing body of data. What is needed is more sophisticated data” (Kennan, 1995).

Given this flurry of activity, it was logical that Brown offered an update to his 1982 review. In his 1999 Handbook of Labor Eco-
nomic chapter on the minimum wage, Brown argues that the weight of evidence now appears to be that the disemployment effect of a minimum wage change is small. Whether one uses the Card and Krueger (1995) results or those of Neumark and Wascher (1996), which tended to be on the low side of the old consensus, the real puzzle was why the employment effect was so small. He offers many ideas to tackle this question, including:

A more sympathetic reading of Myth and Measurement (Card and Krueger’s 1995 book) would view the monopsony model—including models emphasizing search by workers and employers—as being more appropriate some of the time, and so contributing to rather small effects in the aggregate. Progress in testing this possibility will depend on far better understanding of minimum wages and prices—are prices considerably smaller than predicted by the competitive model too? (Brown, 1999, p. 2156)

Over the last few years, we have undertaken a research project that explores both theoretical and statistical models of the output price response to changes in the minimum wage. This paper offers a summary of our findings on the subject to date.

We begin by briefly describing the intuition behind why output prices can be used to infer the structure of a labor market. This section borrows heavily from Aaronson, French, and MacDonald (2004). Next, we summarize attempts to estimate the output price response to minimum wage hikes, concentrating heavily on our own work in Aaronson (2001) and Aaronson, French, and MacDonald (2004). We argue that the sign and size of the price movements observed in much, albeit not all, of the relevant papers is consistent with relatively competitive labor market structures.

Finally, we describe results from Aaronson and French (2003), in which we calibrated a model of labor demand. The model can be used to indirectly pin down the employment response to a minimum wage change. We calibrate the model using, among other things, the elasticity of output price with respect to the minimum wage. We show that if firms are price-takers in the input and output markets, the employment elasticity computed from this computational model of labor demand is plausibly (see Section V below) within the bounds, albeit on the higher side, set by the empirical literature. When that model is augmented to allow employers to potentially have monopsony power in the labor market, but the model is made to match the price responses reported in Aaronson, French, and MacDonald (2004), the calibrated employment elasticity is only slightly smaller than the perfect competition case, again suggestive of a labor market generally consistent with competitive conditions. A further implication of this work is that employment and price changes are negatively related; consequently, both disemployment effects and price increases are possible.

We conclude by describing important qualifiers of our work thus far and additional analyses that we hope to tackle in the near future that might get at some of these concerns. The most important of these qualifiers is that, as Boal and Ransom (1997) point out, our results do not necessarily prove labor markets are competitive. Although the results are clearly consistent with this conclusion, if the minimum wage is set high enough, positive price movements are consistent with the monopsony model as well. The intuition for this result is explained below. However, our results provide evidence against the hypothesis that monopsony power is important for understanding the observed employment responses to minimum wage changes. Although our test answers a fairly narrow question, we believe that the answer to this question is of broad interest. Given that the low observed employment responses to minimum wage changes sparked interest in the importance of monopsony power in the labor market, our results should temper this interest. Nevertheless, our test is not strictly between competition and monopsony,
although we often refer to it as such, for expositional purposes, below.

II. A brief description of the theoretical framework

As Brown (1999) noted, output prices are potentially an alternative way to infer the structure of a labor market. To understand the intuition, we begin with some background on the relationship between employment, minimum wages, and labor market structure. More detail is offered in Aaronson and French (2003) and Aaronson, French, and MacDonald (2004).

Regardless of labor market structure, all firms are assumed to be profit maximizers and thus set the level of employment at the point where the marginal cost of the last worker hired is equal to the extra revenue she produces (her marginal revenue product of labor). In a perfectly competitive labor market, all firms are small, homogenous, earn no economic profits, and have no impact on the market-determined wage. If an individual firm tries to pay more than the market-clearing wage, the firm will eventually go out of business since other firms can produce the same items for less money. If the firm pays less than the market-clearing wage, employees will switch to other equivalent firms that pay the market-clearing wage and again the firm will go out of business. Instead, the firm simply chooses how many employees it wants to hire at the given wage. Therefore, the marginal cost of adding an additional worker is simply the prevailing wage.

If a minimum wage is introduced (or increased) beyond the market-clearing wage in a competitive labor market, the marginal cost of hiring a worker increases. Firms will reduce employment until the marginal cost of labor equals the marginal revenue product of labor. In order for this to happen, employment must decrease. The reason for this is that the marginal revenue product of labor is downward sloping. In other words, each additional worker provides less revenue than the previous worker. Why?

One important reason is that when there are more workers, output is greater. When output is greater, output prices fall. Even if each additional worker produces the same amount as the previous worker, the increased output will reduce prices and thus the marginal revenue product of labor.

However, under monopsony, increasing the minimum wage can cause employment to fall, rise, or have no effect depending upon how high the minimum wage is set. This ambiguity is driven by the observation that the marginal cost of hiring an additional worker does not equal the wage under monopsony. In this market environment, the monopsonist represents market demand for workers. Consequently, unlike the competitive firm, which pays the prevailing market wage regardless of how much labor it demands, if the monopsonist wants to expand its labor force, it has to raise the wage to attract another worker. However, when the monopsonist firm raises the wage to attract that marginal worker, it potentially also has to raise the wage for its existing workforce. The implication is that the marginal cost of hiring a worker is greater than that worker’s wage. Figure 1 shows the wage the firm would have to pay in order to attract an additional worker, w(L), as well as the marginal cost of hiring that worker MC(L). Consequently, when the monopsonist maximizes profits by setting marginal costs equal to marginal product, total market employment, L*, is lower than the competitive case (L**).

If the minimum wage is set high enough, in particular above the competitive market wage (ln w**), the employment response is the same as the perfect competition case: an increase in the minimum wage lowers employment. Furthermore, if the minimum wage is set too low, that is, below where the monopsonist would pay in equilibrium anyway (ln w*), the minimum wage is not binding and therefore has no impact on employment levels.

But a properly placed minimum wage, set somewhere between the wage paid by a monopsonist and the wage paid by a perfect competitor,
will increase employment. The intuition for this result is that, although the minimum wage increases the firm’s average cost of labor, it reduces the marginal cost of labor. Recall that, absent a minimum wage, the marginal cost of hiring that last worker lies above the wage paid by the monopsonist (because everyone’s wage has to be raised in order to induce a marginal worker to join the firm). If the minimum wage is set above the monopsony equilibrium wage but below the marginal cost of hiring a worker, the new marginal cost of hiring a worker falls. Up to a certain point (the competitive equilibrium \( \ln w^{**} \)), the firm no longer has to bump up the pay of its current workforce if it wants to hire a new worker. It’s that reduction in the marginal cost of hiring additional labor that causes firms to expand output and employment in response to the minimum wage increase. This is the situation depicted on the figure, where \( L_{\text{min}} \) is greater than \( L^* \).

So, under fairly general conditions, a minimum wage increase causes employment to decline if local labor markets are competitive but may cause employment to rise if employment is determined monopsonistically. This is the basic empirical test presented in numerous papers in the literature.

This distinction between competitive and monopsonistic output responses allows us to explore the use of prices to infer the importance of monopsony power in the labor market. As previously mentioned, changing the size of the workforce has a direct impact on output; adding an extra worker increases output, while removing a worker decreases output.\(^1\) Hence, one alternative test of competitive structure is to measure what happens to output after a minimum wage change. Although we plan to explore this issue in future work, in our research thus far, we look at another aspect of this change in output. Increases in output caused by increases in labor cause output prices to fall. Conversely, reductions in output caused by reductions in labor input lead to price increases. This is a direct result of downward sloping demand curves, and empirical evidence indicates that not only do demand curves for food slope down, but that demand for food, and food away from home in particular, is elastically demanded (Piggott, 2003).

Note that in the discussion above, we made very little reference to the structure of the product market and to substitution possibilities between different inputs into production. This is because, as noted in Aaronson, French, and MacDonald (2004), our results hold under very general product market structures and very general production functions.

Therefore, the model has some pretty clear implications. First, employment and prices are negatively related, and this relationship holds under quite general conditions for both output and input market structures. Second, prices may rise, fall, or remain steady depending on the level of the minimum wage and the shapes of the labor supply and demand curves. However, a “properly placed” minimum wage, in particular one that falls between the monopsonistic and competitive wage, has a clear implication—output prices fall and employment rises. It is this prediction that can be contrasted to the standard competitive one that output prices rise and employment falls in response to a change in the minimum wage. We next turn to empirical estimates of this price response.

III. Empirical evidence that output prices respond to changes in the minimum wage

Until recently, very few papers attempted to measure the extent to which increases in pay associated with minimum wage changes are passed through to consumers. The first such studies were performed by the Department of Labor back in the 1960’s (see Wessels, 1980 for a description). These studies compared output good price responses to minimum wage changes in 1961 and 1967 in Southern (i.e., low-wage) and non-Southern firms. They found that ser-
vice prices, but not manufacturing prices, rise faster in locations where the minimum wage is more likely to bind.

More recently, Katz and Krueger (1992) and Card and Krueger (1995) collected price information from respondent restaurants in their research on fast food restaurants. Due to the imprecision of their estimates, their results are mixed and difficult to interpret. Generally, they find little evidence of price inflation in their sample of Texas fast food outlets but more, yet still mixed, evidence in the New Jersey-Pennsylvania experiment. However, this work is limited to restaurants in three states and two minimum wage episodes, and in all cases their estimates are very imprecise. Other work by Card and Krueger involves a broader cross-sectional sample of U.S. cities. Here, they use the Consumer Price Indices (CPI) for Food Away from Home in 27 large metropolitan areas over a three-year period (1989 to 1992), finding larger price increases in those cities with higher proportions of low-wage workers. Although their estimates are consistent with full pass-through, their standard errors are extremely large. They cannot reject zero price pass-through in many of their specifications. As a result, they conclude that their estimates are “too imprecise to reach a more confident assessment about the effects of the minimum wage on restaurant prices” (p. 148).

Our first paper (Aaronson 2001) on this topic takes a tack similar to Card and Krueger’s CPI analysis but extends their work in several dimensions. Aaronson collected price data from three sources. First, like Card and Krueger, he uses the city-level CPI for Food Away from Home, but covers an 18-year period—1978 to 1995—which was, because of the high inflation of the 1970’s and early 1980’s, the golden age of minimum wage legislation. During this short period, the U.S. government increased the federal minimum wage six times, and 15 of the states passed 39 separate state-specific increases that were at least six months apart from federal enactment dates. Second, Aaronson uses the equivalent CPI for Canada, where the geographic variation in minimum wage laws is even more pronounced. Over the same 18-year period, the 10 Canadian provinces enacted 97 minimum wage increases. Finally, he utilizes a less well-known, but more detailed, city-level price index on fast food meals from the American Chamber of Commerce covering 1986 to 1993. The Chamber of Commerce offers a wider breadth of geographic coverage—almost four times as many cities as the CPI—and reports meals (McDonald’s hamburger, Kentucky Fried Chicken chicken, and Pizza Hut pizza) that are likely to be heavily influenced by low-wage labor costs. The drawback is that the survey is not scientifically rigorous, and therefore measurement error is much more pronounced.

Regardless, across all three datasets, Aaronson finds that prices tend to rise in reaction to a minimum wage change. Figure 2 offers evidence from the U.S. CPI data. The vertical axis reports the excess price response in the nine months (four months before to four months after) around typical minimum wage enactment dates. These months are counted on the horizontal axis (with month 0 representing the legislation enactment date and negative [positive] numbers representing months prior to [post] the enactment date). There are two solid lines. Both lines are derived from a regression of log Food Away from Home prices on indicator variables representing minimum wage months. The first line also controls for city, year, and month fixed effects. That is, we look to see how prices vary in minimum wage versus nonminimum wage months but only exploit variation within-city and within-year, while still controlling for any seasonality in price changes not already captured by the BLS’ seasonal adjustments. For example, if there is a minimum wage change in October in Philadelphia, we are comparing food away from home inflation in Philadelphia in the months in and around October to Food Away from Home inflation in Philadelphia in months that same year that are not within four months of minimum wage legislation (i.e., the first half of that
The second solid line goes even farther by also controlling for city-specific and national overall and Food at Home inflation, as well as city-specific and national employment growth, around the minimum wage enactment dates. The dashed lines offer standard error bands for these calculations.

What is striking is the timing and magnitude of the price increases. Within three months of the minimum wage enactment date, output prices on restaurant meals rise, in total, roughly 0.4 to 0.7 percent (with standard errors of approximately 0.2 percent) in reaction to a typical 10 percent increase in the minimum wage, with the majority of this change occurring within a month of the enactment date. Other results reported in Aaronson (2001) show that this is the complete response. Prices do not change significantly beyond this nine-month period. For fast food meals, the impact is, unsurprisingly, substantially higher, approaching 1.5 percent in some specifications.

While this data is illuminating, it has some flaws, the most important of which is the inability to distinguish the intensity of minimum wage labor usage. With that in mind, we were granted access to the store-level data employed to construct the Food Away from Home component of the CPI during 1995 to 1997. While the time frame is somewhat short, this three-year period contains an unusual amount of minimum wage activity. A bill signed on August 20, 1996 raised the federal minimum from $4.25 to $5.15 per hour, with the increase phased in gradually. An initial increase to $4.75 (11.8 percent) occurred on October 1, and the final installment (8.4 percent) took effect on September 1, 1997. Moreover, additional variation can be exploited since price responses will vary geographically. This occurs for two reasons. First, market wages may exceed minimum wages in some areas but not in others. Second, some states set minimum wages above the federal level. The sample itself is based on nearly 7,500 food items at over 1,000 different establishments in 88 geographic areas.

Again, we find clear evidence that prices rise after the minimum wage is raised. During the two months after a minimum wage increase, 22.4 percent of LS items increased in price. This is almost double the 11.4 percent share of LS price quotes that are increased in months without a minimum wage increase. Moreover, as expected, the minimum wage effect is substantially smaller for full service outlets. In such stores, the share of quotes that are higher than the previous two months is 11.2 percent, exceeding months that do not follow a minimum wage increase by only 0.4 percentage points.

The monopsony model predicts that employment and output rise, and therefore prices decline in response to the minimum wage increase. However, there is little evidence for this in the data. The share of prices that are cut in any given bimonth is remarkably stable—roughly 2.6 percent for LS meals and 1.7 percent for FS meals—regardless of whether the minimum wage has been altered. Therefore, based on incidence alone, the data suggests that many firms are able to raise their prices, but few reduce them, in response to a change in the minimum wage.
More complete statistical models of price responses corroborate these simple descriptive statistics (See Aaronson, French, and MacDonald, 2004 for details). We find that a 10 percent increase in the minimum wage increases restaurant prices by roughly 0.7 percent (with a standard error of 0.14), and of LS establishments in particular by 1.6 percent (with a standard error of 0.3 percent). The latter result is quite consistent with our findings using the American Chamber of Commerce price survey described in Aaronson (2001). And, similar to Figure 2, the price response is rapid, occurring within months of the enactment dates.

Furthermore, we show that the price response varies in the expected direction depending on the market wage of local labor markets. Where prevailing low-skill wages far exceed minimum wages, minimum wage increases will have little impact on market wages and consequently costs. Where minimums bind for low-skill workers, changes in the minimum wage will have strong effects on observed wages and thus costs. In fact, we find that minimum wage increases have larger effects on prices in low-wage areas, particularly among limited service outlets. An MSA where the 20th percentile of the 1996 hourly wage is $5.50 leads to a 0.88 percent price increase among all outlets and a 1.73 percent increase among limited service outlets. At a wage of $7.50, this effect drops to 0.56 and 1.17 percent for all and limited service firms, respectively. At a wage of $10.00, the price impact is negligible for the full sample and drops to below 0.5 percent for limited service establishments. Finally, we document that, not only is the sign of the price response consistent with perfect competition, but the magnitude of the response is as well.

One possible objection to these findings is that restaurants react to cost changes by changing the quality of the product. If the minimum wage increases, firms could, for example, leave the price the same but cut portion size or the quality of the ingredients. This would suggest that we are underestimating the size of the price changes. However, we do not believe this is the case. The BLS strives to price identical items over time, and codes in our database describe temporal item substitutions due to discontinuance or alteration. In our analysis, we focus on price changes for identical items, so we do not compare prices of items that have been altered. Furthermore, while we do not have direct measures of product quality, we can test whether there is an increased incidence of item changes or substitutions following minimum wage changes. We found no such evidence, suggesting that quality changes or item substitution are not a standard means of dealing with a cost shock.

IV. What can we infer about the employment response to a change in the minimum wage?

Aaronson (2001) and Aaronson, French, and MacDonald (2004) identify the stylized facts regarding pricing strategies around minimum wage changes. Our last paper, Aaronson and French (2003), develops methods to use these estimates to formally infer the degree of competitiveness in the food away from home labor market. Before briefly describing what we do, we think it is important to point out that although there are literally hundreds of papers that use the minimum wage to test labor market structure, few explicitly show what the competitive and monopsony models imply.

Aaronson and French (2003) calibrate a model of labor demand to infer the employment response to a change in the minimum wage in the food away from home industry and explicitly show the employment and price responses implied by the two models. Assuming a perfectly competitive labor market, our model predicts a 2.5 to 3.5 percent fall in employment in response to a 10 percent minimum wage change. The intuition for this result is that, in the competitive model, the price of a hamburger (as
well as all other output goods) equals its marginal cost both before and after the minimum wage change. Therefore, higher labor costs caused by the increase in the minimum wage must be passed on to the consumer in the form of higher prices. But higher output prices imply the quantity of output falls. Because the quantity of output falls, the quantity of at least one of the inputs to production must also decline. Moreover, since the increase in the minimum wage causes the price of labor to increase, firms will tend to substitute away from the costly input (labor) to other inputs. For example, many restaurants now use cash registers that no longer need the price of an item to be inputted, just a picture of the item itself. Because both the quantity of output falls and because firms substitute from labor to other inputs, the quantity of labor demanded must go down in response to a minimum wage hike.

We find that, given the model and parameter estimates taken from other studies, both the effect from reducing total output and substituting from labor to other inputs are important. In sum, a 10 percent increase in the minimum wage should reduce minimum wage employment by about 10 percent. However, only about 30 percent of all restaurant industry workers are both covered by the minimum wage and are paid near the minimum wage. As a result, a 10 percent increase in the minimum wage should reduce restaurant industry employment by about 3 percent.

We then augment the model so that employers potentially have monopsony power in the labor market. Recall that whereas the competitive model implies that employment falls and prices rise in response to an increase in the minimum wage, the monopsony model potentially implies that employment can rise and prices fall in response to an increase in the minimum wage. An implication of this model is that when employment rises, output also rises and thus output prices fall. Therefore, the competitive and monopsony models have opposite employment and output price responses to changes in the minimum wage when the minimum wage is in a proper zone (between the unrestricted monopsonistic and competitive wage).

We show that the price response calculated in our earlier work is consistent with the prediction of the competitive model. We estimate that a 10 percent increase in the minimum wage increases prices by about 0.7 percent. The competitive model predicts that a 10 percent increase in the minimum wage increases prices by 0.8 percent, whereas the monopsonistic model predicts that prices fall by at least 1 percent. As a result, we infer that monopsony power is relevant for fewer than 10 percent of all restaurants that pay near the minimum wage. Calibrating the full model, we place fairly tight bounds on the elasticity of demand for labor with the most plausible parameter values suggesting a 2 to 2.5 percent loss in employment in reaction to a 10 percent increase in the minimum wage. All of these predictions are robust to allow for imperfect competition in the product market as well.

V. How do these estimates compare to the literature?

As is clear to any observer of this literature, there no longer seems to be a consensus estimate of the employment response to a change in the minimum wage. If anything, the literature, as described in Brown (1999), seems to lean toward the low end of the old consensus. That is, a 10 percent increase in the minimum wage causes a small, perhaps 1 percent, decline in teenage employment. This actually turns out to be the median response in a survey of professional labor economists published in the Journal of Economic Literature (Fuchs et al., 1998). But the mean response was 2 percent, with a full quarter of participating labor economists believing the disemployment effect is at least 3 percent. Thus our estimate of 2 to 2.5 percent appears to be well within the bounds, albeit at the higher end, set by the literature.

One difference between our sample of restaurant workers from large (CPI) cities and the usual national sample of teenagers is that, on
average, about 55 percent of all teens are paid within 20 percent of the minimum wage. By contrast, the share of workers in CPI-city eating and drinking establishments who are paid within 20 percent of the minimum wage is roughly 33 percent. However, as Brown (1999, p. 2114-15) points out, the teen figure is likely an overestimate of the number of teens affected by the minimum wage since many teens are not covered by minimum wage legislation. Therefore, to infer the elasticity of demand for teenagers, the minimum wage employment elasticity must be adjusted upward (Brown’s Table 2 makes these adjustments). Once these adjustments are made, the teen estimates in the literature are of the same order of magnitude as our own. Moreover, fast food may be more elastically demanded than other products that teenagers produce, such as clothes or groceries. Therefore, our implied employment elasticities strike us as plausible.

VI. Conclusion and Future Research

We propose a simple but quite general model of employment determination that shows employment and prices are negatively related. In this model, prices may rise, fall, or remain steady depending on the level of the minimum wage and the shapes of the labor supply and demand curves. However, a “properly placed” minimum wage, in particular one that falls between the monopsonistic and competitive wage, has a clear implication—output prices fall and employment rises. It is this prediction that can be contrasted to the standard competitive one that output prices rise and employment falls in response to a change in the minimum wage. Empirical results using store-level and aggregated city-level data, both in the U.S. and Canada, show that most, if not all, of the higher labor costs incurred by restaurant employers are pushed on to consumers in the form of higher prices.

Arguably, these empirical findings—that marginal cost shocks are passed on to consumers through higher output prices—may be consistent with small disemployment effects. If restaurants face factors that limit their ability to raise prices, say through high transaction costs to switching prices or a price elasticity of demand for food away from home that is infinitely elastic, the predicted disemployment effects of a minimum wage increase would be larger than if these factors did not hinder price behavior. If these factors are important, strong price responses suggest that employment effects could be muted. Instead, we interpret our results to be consistent with the moderate disemployment effects reported in the model discussed in Aarson and French (2004). There, we calibrate a structural model of labor demand with a price increase of a magnitude consistent with our empirical work and show that a 10 percent increase in the minimum wage reduces restaurant employment by roughly 2 percent, a short-run response that is within the range of estimates found in the literature. Thus, both disemployment effects and price increases are possible.

To be clear, our results do not necessarily prove labor markets are competitive. Although the results are clearly consistent with this conclusion, if the minimum wage is set high enough (i.e., above the competitive wage), positive price movements may be consistent with the monopsony model as well. However, our results provide evidence against the hypothesis that monopsony power is important for understanding the observed small employment responses to minimum wage changes. Although our test answers a fairly narrow question, we believe that the answer to this question is of broad interest. Given that the low observed employment responses to minimum wage changes sparked interest in the importance of monopsony power in the labor market, our results should temper this interest. Nevertheless, our test is not strictly between competition and monopsony.

The other important caveat to our results to date is that inferences are reserved for the restaurant industry only. Nevertheless, this industry is a major employer of low-wage labor and therefore a particularly relevant one to
study. Eating and drinking places (SIC 641) is the largest employer of workers at or near the minimum, accounting for roughly one-fifth of such employees in 1994 and 1995. The next largest employer, retail grocery stores, employs less than 7 percent of minimum or near minimum wage workers. Moreover, the intensity of use of minimum wage workers in the eating and drinking industry is amongst the highest of all sectors, with approximately 23 percent of all workers, encompassing 11 percent of the industry wage bill, within 10 percent of the minimum wage.\textsuperscript{10}

In the future, we plan to enhance our research in a number of new ways. First, it is our hope that this work has augmented the literature’s almost exclusive focus on wage and employment behavior. The next step is to meld these responses by looking at employment, prices, and wages simultaneously, to gauge whether the hypothesized relationship between employment and prices actually appears in the data. We plan to accomplish this by merging our store-level pricing information with store-level employment data from the BLS’ ES-202 and Current Employment Statistics databases. We also hope to look more broadly at other firm outcomes, with a particular interest in entry and exit, investment, and revenue decisions based on the Census’ Longitudinal Business Database. We believe that this project, at its conclusion, will give a more complete understanding of the varied ways that firms respond to exogenous cost shocks.
Endnotes

1. This result is robust to allow capital to adjust under any empirically reasonable situation.

2. Another 14 were within six months of federal changes.

3. For the hamburger and chicken data, a 10 percent increase in the minimum wage increases prices by 1.5 percent. But somewhat surprisingly, Aaronson found no price response for Pizza Hut pizza data.


5. These results are robust when looking at price movements at the store-level as well. Furthermore, increasing the frequency of price changes is not the only avenue for firms to raise or lower prices. The size of price changes could be altered as well. But we found little evidence that this is the case.

6. We are able to perform this test because our data include precise outlet locations (addresses and telephone numbers) that we link to MSA hourly wage distributions estimated from the 1996 Current Population Survey (CPS).

7. These figures are from the CPS Outgoing Rotation files, covering 1979 to 2002. Teens are defined as 16 to 19 year olds. Restaurant workers are those in eating and drinking establishments. CPI cities are the 27 MSAs for which the aggregated data is reported.

8. The adjustments in Brown are based on wage distributions for 16 to 24 year olds, as calculated in Neumark and Wascher (2002). He argues that the share of workers in this age group impacted by the minimum wage is closer to 20 percent. This would suggest that the elasticity of demand for teenagers should be factored up 1/0.2=5. However, since this calculation is based partly on 20 to 24 year olds, a more conservative guess for 16 to 19 year olds would be 3.

9. We should note that these results are based on minimum wage experiments involving state-wide (or nation-wide) legislation that is typically all-encompassing. That is, the scope of the ordinance is widespread. We cannot generalize our empirical findings to legislation that exempts particular establishments, say those under 25 employees, because this would clearly allow for substitution between (otherwise identical) firms.

10. All calculations in this paragraph are based on the Current Population Survey’s outgoing rotation groups.
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(dashed lines are standard error bands)

Controls for city, year, month fixed effects

Controls for city, year, month fixed effects and city, national inflation and employment trends

Illustrations of monopsony equilibrium with minimum wage
(Bold line denotes ln MC \( (L) \) curve)
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