CAN RESCHEDULING EXPLAIN THE NEW JERSEY MINIMUM WAGE STUDIES?

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INTRODUCTION

In a recent and storied paper, David Card and Alan Krueger [1994] claim to find evidence that the 1992 New Jersey minimum wage hike raised the level of employment in fast food restaurants in that state (although not significantly by conventional statistical standards). In response, David Neumark and William Wascher [2000], using data on payroll hours, claim to show employment declined in the New Jersey restaurants. While both teams loosely characterize the labor input in terms of "full-time equivalent employees", the Card-Krueger data set includes the number of workers and the Neumark-Wascher data set (with the exception of a subsample described in more detail below) includes the total number of hours. A major issue in this ongoing debate, which now includes a reply from Card and Krueger [1999], has been the quality of the respective data sources. This paper focuses instead on a rescheduling hypothesis, according to which both studies may be right.

Firms have the option of cutting back on labor services either by laying off workers or by reducing the length of the scheduled workweek. Since total payroll hours are the product of the number of workers and their average workweek, it is algebraically possible for the number of workers to remain constant while weekly hours per worker (and thus total payroll hours) decline.¹ To explore this rescheduling scenario, we present a simple model of the demand for workers and weekly hours per worker that shows why a wage increase could, in principle, induce firms to hire more workers, (consistent with Card and Krueger's finding) while reducing the workweek. In this model, the firms' total demand for hours will decline (consistent with Neumark's and Wascher's finding). The model is then tested in the data sets that these two research teams have made available where the rescheduling hypothesis receives some support.²

In their original study, Card and Krueger [1994] conducted a telephone survey of fast-food restaurants before and after the New Jersey minimum wage went into effect. The survey asked for the number of employees on the payroll, the starting wage, and other relevant data. Card's and Krueger's analysis of these data showed that employment (measured by the number of workers) in New Jersey restaurants increased by more than employment in restaurants in contiguous counties in Pennsylvania, although the difference was not statistically significant. Their methods and

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results have been criticized by Neumark and Wascher [2000], who point out that telephone surveys are prone to error. Neumark and Wascher, using payroll data initially supplied to them by the Employment Policies Institute, found that employment (measured by total payroll hours) declined in the New Jersey restaurants relative to their Pennsylvania counterparts.

How one assesses the evidence about the New Jersey minimum wage experiment depends on whether the purpose of the assessment is to clarify the empirical validity of economic theory or to inform policy. Card and Krueger are chiefly interested in empirical support for contending theories of the firm and the labor market; their original finding questions the validity of the competitive model of the firm and points toward an imperfectly competitive monopsonist as representative of the low-wage labor market [Card and Krueger, 1995, 11-13]. Neumark and Wascher have cast themselves in the role of defenders of the standard competitive model [Neumark and Wascher, 1996, 57]. With these stakes, it makes good sense to scrutinize the data sources meticulously. This paper provisionally accepts the validity of the data sources in order to focus on the policy question itself.

From a policy standpoint, what matters is whether minimum wage programs effectively redistribute income to the targeted population with minimal unwanted side effects. We will argue that even accepting the validity of the data used by Neumark and Wascher and the conclusions they draw from it, a case can be made that the New Jersey minimum wage had no effect on the number of workers (i.e., jobs) and that if it had any effect on labor demand it was to reduce weekly hours per worker. Since, as we will argue, the minimum wage reduced weekly hours by proportionately less than the wage increased, it left the targeted population better off, earning more income, working fewer hours, and enjoying more leisure. We reach the conclusion that the New Jersey minimum wage improved welfare for the targeted population using data collected by the Employment Policies Institute (an institution partially funded by the fast-food industry, which presumably has a vested interest in discrediting minimum wage programs), thereby creating an *a fortiori* case favorable to the minimum wage since any suspected bias in the data would be in the opposite direction.

A MODEL OF SCHEDULING

In order to reduce the problem to its most elementary level, we will assume (at least initially) that at the industry level the demand for output is inelastic, that output remains fixed, and that the number of firms remains constant (restricting us to the short-run effects of a wage increase). These assumptions eliminate any scale or output effects that might complicate the argument, which hinges on the possibility of substituting a larger workforce for shorter hours to produce the same level of output. We also assume a competitive product market.

For concreteness and simplicity, let us implement this model with a production function in Cobb-Douglas form having no other inputs except hours and workers, such as:

$$(1) \quad q = h^\alpha N^\beta \quad 0 < \alpha < \beta < 1.$$

In this production function, q is the output level of the representative firm which hires N workers (ignoring integer constraints, or literally permitting the firm to hire fractions of people) and schedules them to work h hours per week. Total payroll hours, E , are simply the product of weekly hours per worker and the number of workers, or

$$E = hN.$$

In this model of production, payroll hours are not an adequate measure of labor input because workers and weekly hours per worker are not equally productive of effective labor services.³ Consider two ways of increasing payroll hours by one percent: additional hiring or longer hours per week. A one percent increase in the number of workers increases output by less than one percent because of diminishing returns induced by, for example, congestion.⁴ A one percent increase in the work week will increase output by less than one percent as workers become less effective through fatigue or diminished motivation. We assume that the proportional increase from hiring more workers exceeds the increase in output from working longer hours, or that $\alpha < \beta$; as we will see, a meaningful solution requires this restriction.

The representative firm will produce its output level, q_0 , using the number of workers and hours per week that minimizes its costs, C . Let there be a fixed cost, F , for each worker (fringe benefits, recruiting costs and training costs are possible examples) and let the hourly wage be represented by w . For technical reasons, we also need to include some other fixed cost M , such as a franchise or incorporation fee.⁵ The firm's optimization problem then is

$$\text{minimize } C = M + FN + whN$$

$$\text{subject to } q = h^\alpha N^\beta \text{ and } q = q_0.$$

From the first-order conditions for this problem we can derive the following conditional demand functions for weekly hours per worker and workers:

$$(2) \quad h^* = (\alpha F)/w(\beta - \alpha)$$

$$(3) \quad N^* = (q_0^{1/\beta})(h^*)^{-\alpha/\beta}.$$

The demand for workers and weekly hours per worker conforms to textbook wisdom and common sense.⁶ An increase in the fixed cost of hiring workers will induce firms to lengthen the working week and shed workers. An increase in the cost of employing hours per worker (i.e., the wage) will induce firms to reduce the working week, and take on additional workers. These are pure substitution effects that move the firms along a scheduling isoquant. Curiously, the level of output does not affect the optimal weekly schedule, h ; it only affects the optimal number of hires, N . We exploit this fact below in discussing the complications that would arise if scale effects were to enter the picture.

Since total payroll hours are the product of the number of workers and their weekly hours, we can also write a demand curve for total hours. Taking logs, we have

$$(4) \quad \ln E^* = (\beta - \alpha)/\beta \ln h^* + 1/\beta \ln q_0.$$

Differentiating equation (4) with respect to the log wage yields the following expression for δ , the wage elasticity of total hours:

$$(5) \quad \delta = (\alpha - \beta)/\beta.$$

We can see immediately from equation (5) that payroll hours would decline after a wage increase (recall that $\alpha < \beta$). Therefore, this simple model is consistent with both the findings of the Neumark and Wascher study (showing that payroll hours declined after an increase in the minimum wage) and those of the Card and Krueger study (showing that the number of employees may have increased at the same time). Put differently, one cannot conclude that Neumark and Wascher have "refuted" the Card-Krueger study, since the theoretical possibility exists for both results to be consistent.⁷ We will show in the next section that some evidence exists that this is in fact a likely explanation, and not merely a theoretical possibility.

How would a New Jersey-style minimum wage increase (roughly 17 percent) affect the welfare of the workers? From equation (2) we can see that the elasticity of hours per worker with respect to the wage is -1 . Therefore, with a 17 percent wage increase (let us take it to be 17 percent, although it would probably be less since many workers receive wages just above the minimum) existing staff works 17 percent fewer hours per week, and receives the same weekly pay. They should have no complaints since they now enjoy more leisure. As firms substitute workers for weekly hours, the newly hired workers are also presumably made better off. There is no support here for the claim made publicly by several prominent economists that Neumark's and Wascher's study shows that there must have been losers among the low-wage workers of New Jersey in this episode.

Introducing a scale effect could explain why Card and Krueger found no statistically significant effect on the number of workers.⁸ If the minimum wage increase affects an individual firm in a competitive industry, the increase in marginal costs with normal inputs will reduce the firm's optimal level of output, given that the product price remains constant. If, as is more relevant, the increase in the wage affects all the firms in the industry, the increase in their marginal cost schedules will push prices up and reduce the demand for output. These scale effects reduce the derived demand for payroll hours. From equations (2) and (3) we see that this will be effected exclusively through a reduced demand for workers since from equation (2) it is apparent that scale does not affect hours per week. Card's and Krueger's findings are therefore consistent with the case where the substitution effect (increasing the demand for workers) and scale effect (decreasing the demand for workers) are a wash.

If the substitution and scale effects leave the number of workers unchanged, total payroll hours decline because the substitution effect reduces the scheduled workweek of the existing workers. Nonetheless, our earlier conclusion that there are only win-

ners among the existing workforce remains intact; these employees will be working fewer hours per week, earning the same monetary income, and enjoying more leisure.

EVIDENCE SUPPORTING THE RESCHEDULING HYPOTHESIS

We can test the rescheduling hypothesis generated by the model developed above, to some extent at least, in the data sets made available by Neumark and Wascher and Card and Krueger. The Neumark-Wascher data set was collected in several steps by both the economists themselves and by the Employment Policies Institute three years after the New Jersey minimum wage took effect, through a questionnaire asking for the number of non-management payroll hours in February and November of 1992. The details of this data collection can be found in Neumark and Wascher [2000] or Card and Krueger [1999]. For our purposes, what is important is that a subset of 52 restaurants responded by volunteering data on the *number* of non-management employees as well as their total payroll hours. We test the rescheduling hypothesis in this data subset.

The data were reported in each of two waves (i.e., before and after the minimum wage took effect) according to the length of the payroll period, weekly or bi-weekly. (The data subset contains no observations with monthly reporting, although the full data set does contain such observations.) Thus, for each wave (corresponding to one month) there are up to four separate observations. In order to obtain a matched set on workers and hours per worker, I calculate the average number of workers and average payroll hours per week over each of the two waves of observation.⁹

The obvious way to implement the scheduling model in these data would be to estimate the scheduling isoquant for the restaurants to see if the model goes through in the data. The basic log-log estimating form for equation (1) would be

$$(6) \quad \ln h = (1/\alpha) \ln q - (\beta/\alpha) \ln N.$$

Unfortunately, the data subset contains no measure of the level of output or sales, so we are restricted to estimating an equation with an omitted variable that is strongly correlated with the independent variable, workers, and (if the assumptions of the model are right) uncorrelated with the dependent variable. The correlation between workers and output is likely to be quite strong, so the resulting estimate of the coefficient on workers will be biased upward. This problem is not too troubling in light of the fact that we primarily seek evidence for the presence of a scheduling isoquant, not corroboration that it takes the Cobb-Douglas form. If we wanted to corroborate the Cobb-Douglas form, it would be important to test for the restriction that $\alpha < \beta$, but the omitted variable bias makes this too ambitious.

The results of estimating equation (6) appear in Table 1. The coefficients on the log of workers have the predicted negative sign, and they are significant by a comfortable margin (absolute *t*-statistics are all over 4, for example). This lends strong support for the presence of a scheduling isoquant. As discussed above, the apparent slope of the isoquant falls short of the predicted value (greater than unity), but because of the omitted variable bias it is not possible to test the inequality restrictions.

TABLE 1

Estimates of Scheduling Isoquants for NJ and PA Restaurants
(Neumark-Wascher Data Set)

Variable	Regression 1	Regression 2	Regression 3
Intercept	4.032 (0.226)	4.127 (0.218)	4.000 (0.228)
Log Workers	-0.270 (0.067)	-0.313 (0.066)	-0.280 (0.068)
Wave 2 Dummy		0.092 (0.029)	0.090 (0.028)
NJ Dummy			0.052 (0.030)
R ²	0.136	0.217	0.240
SER	0.022	0.020	0.020

Standard errors are in parentheses; the number of observations is 104. Dependent variable is Log Hours per Worker. See text for data sources and methodology.

Including a dummy variable on the second wave observations made after the New Jersey minimum wage took effect might partially control for scale effects. The dummy for wave two suggests that restaurants in this whole region (New Jersey-Pennsylvania) enjoyed buoyant demand conditions and expanded their employment (both hours per worker and number of workers) by just under ten percent. (Note that this buoyancy is not so evident in the Card-Krueger data reviewed below.) Adding the wave two dummy raises (slightly) the coefficient on log workers, consistent with the hypothesis of omitted variable bias. Adding a dummy for restaurants in New Jersey shows some tendency for the New Jersey establishments to be larger than their Pennsylvanian counterparts (another characteristic not evident in the Card-Krueger data).¹⁰

We can visualize this implementation of the scheduling model in Figure 1, which shows log workers and log hours per worker for each of the two waves, as well as the predicted isoquants from column 3 of Table 1 (evaluated at dummy variable means). This figure and the results in Table 1 together illustrate that the rescheduling hypothesis is plausible. Individual restaurants seem to be arranged along a scheduling isoquant, which is apparent despite the absence of data on restaurant output. Determining whether the isoquant actually takes the Cobb-Douglas form or whether this is merely a reasonable local approximation would require a richer data set. It remains to be demonstrated that the New Jersey restaurants moved along the scheduling isoquant in response to the new statutory minimum wage.

We test for the rescheduling hypothesis directly through a difference-in-differences analysis as reported in Table 2. An advantage of this methodology is that it does not impose the Cobb-Douglas structure on the data. The technique is to compute the change or "difference" in each variable (workers, hours per worker, or total payroll hours), by state, from wave 1 to wave 2, and then to test for differences between the changes in the two states (hence "difference-in-differences"). The data in Col-

FIGURE 1
Scheduling Isoquants for NJ-PA Restaurants

umns 1 and 2 show the average levels for New Jersey restaurants; data in Column 3 show the average change. Data in Columns 4 and 5 show the average levels for Pennsylvania restaurants; data in Column 6 show the average change. The difference-in-differences in Column 7 of Table 2 are obtained from a regression of the changes on a dummy variable for New Jersey restaurants. Column 8 uses the same technique, but with log differences so that the results can be interpreted as percentage changes.

The results in Table 2 are consistent with the rescheduling hypothesis. The New Jersey restaurants enjoyed somewhat greater growth in the number of workers than the Pennsylvania restaurants, but somewhat less growth in hours per worker. The difference-in-differences in Columns 7 and 8 for workers are positive and those for payroll hours are negative, but in neither case are they statistically significant. However, the relative decline in weekly hours per worker in New Jersey restaurants is statistically significant at the 10 percent level and just misses significance at the 5 percent level in log differences.¹¹ Thus, these results are consistent with Card's and Krueger's original finding that employment (number of workers) was not affected significantly by the New Jersey minimum wage, and are consistent with (or at least do not contradict) Neumark's and Wascher's finding that payroll hours declined among the New Jersey restaurants. It would appear that the typical fast-food worker in this sample experienced no change in employment status and a reduction of approximately

TABLE 2
Changes in Employment and Hours per Worker in NJ and PA Restaurants
(Neumark-Wascher Data Set)

Column	New Jersey			Pennsylvania			7	8
	1	2	3	4	5	6		
	Wave 1	Wave 2	Change	Wave 1	Wave 2	Change	Difference in Differences	Log Difference in Differences
Workers	25.5 (6.3)	28.4 (6.7)	2.92 (2.42)	29.1 (5.6)	31.2 (7.0)	2.14 (4.59)	0.78 (1.14)	0.044 (0.038)
Hours per Worker	23.97 (4.24)	24.61 (4.15)	0.64 (2.23)	21.46 (4.04)	23.32 (3.09)	1.87 (2.62)	-1.22 (0.72)	-0.062 (0.031)
Payroll Hours	598.6 (110.8)	687.0 (130.0)	88.4 (49.1)	618.0 (131.8)	721.5 (153.9)	103.6 (75.5)	-15.18 (19.36)	-0.018 (0.029)

Standard deviations are in parentheses in first six columns; standard errors are in parentheses in last two columns. For data description and methodology, see text. There are 19 restaurants in New Jersey and 33 in Pennsylvania.

1.22 hours worked per week (i.e., one hour and fifteen minutes), or in other words a 6 percent reduction in weekly hours.

Since we do not know exactly how much wages increased in New Jersey, we can only put the wage elasticity of hours per worker in a range. At most the wage increased by the full amount of the statutory mandate, 17 percent. Card and Krueger estimate [1995, Table 2.3] that the average starting wage increased by around 11 percent, which is probably an upper bound on the increase in the effective wage for all workers, including seasoned veterans. From the log difference-in-differences in Column 8 of Table 2, we estimate that hours per worker declined by about 6 percent. Thus, the implied elasticity of hours per worker with respect to the wage is no lower than 0.35 (i.e., 6/17) but is probably higher than 0.55 (i.e., 6/11). Only if the effective wage increase were 6 percent would the elasticity conform to the value of unity predicted by the theoretical model with Cobb-Douglas isoquants.

What effect did the New Jersey minimum wage have on the welfare of the targeted population? If wages increased by the full 11 percent by which starting wages were apparently increased, this would mean the typical worker enjoyed an increase in weekly pay of around 5 percent, with a proportional increase in leisure time of comparable magnitude. Even if wages had increased by only 6 percent, the amount conforming with the unitary elasticity predicted by the theoretical model, the typical worker would be working fewer hours for the same income and enjoying an improvement in welfare driven by increased leisure. It is, of course, possible that the elasticity of weekly hours with respect to wages exceeds unity, in which case wages would not have increased by as much as 6 percent, but it is more plausible that this elasticity is less than unity, in which case wages would have increased by more than 6 percent. One reason to believe that the average wage rose by 6 percent or more is that the New Jersey minimum wage went into effect only one year after the Federal

TABLE 3
Fraction Full-Time and Total Workers in NJ and PA Restaurants
(Card-Krueger Data Set)

Column	New Jersey		Pennsylvania		Correlation Coefficient	
	1 Wave 1	2 Wave 2	3 Wave 1	4 Wave 2	5 Wave 1	6 Wave 2
FTEs	20.4 (9.1)	21.0 (9.3)	23.3 (11.9)	21.2 (8.3)	0.499	0.451
FT/FTE	0.328 (0.238)	0.358 (0.245)	0.350 (0.239)	0.304 (0.245)		
FT+PT	26.4 (11.9)	26.7 (12.3)	29.7 (14.2)	27.5 (10.2)	0.130	-0.011
FT/(FT+PT)	0.286 (0.232)	0.321 (0.251)	0.303 (0.236)	0.260 (0.242)		

FT represents Full-Time Workers, PT represents Part-Time Workers, and NMGRS represents number of managers. FTE is Full-Time Equivalents using Card's and Krueger's definition, or .5(PT)+FT+NMGRS. Standard deviations are in parentheses.

minimum wage had been increased to \$4.25 an hour in 1991. As a result, a high proportion of restaurant workers were affected by the New Jersey increase to \$5.05. Card and Krueger [1995, Table 2.1] report that 30 percent of New Jersey restaurants had a starting wage of \$4.25 before the state minimum took effect. After the state minimum was implemented, 85 percent of New Jersey restaurants had a starting wage of \$5.05 in comparison to only 1 percent of Pennsylvania restaurants. Therefore, the evidence suggests that the New Jersey minimum wage improved welfare for the targeted population by increasing wages proportionately more than weekly hours declined.

As a final exercise, let us turn to the Card-Krueger data set, which distinguishes between part-time, full-time and managerial employees. One might expect the ratio of full-time to total employment to be a good metric for the average number of hours per worker. Under this interpretation, the Card-Krueger data flatly contradict the rescheduling hypothesis. Card and Krueger themselves found some evidence that they describe as "ambiguous" [1995, 47] for an increase in the proportion of full-time workers. This result is apparent in the descriptive statistics reported in Table 3. Card and Krueger calculate full-time equivalents (FTE's) by adding together the full-time workers, the managers, and one-half the part-time workers, and they measure the fraction full-time by dividing full-time workers (but not managers) by FTE's. It is clear that in the New Jersey restaurants, the fraction full-time increased slightly, while in the Pennsylvania restaurants this fraction decreased, in apparent contradiction to the rescheduling hypothesis.

One might object that these definitions do not conform to the earlier measures, which covered only non-managerial employees and which did not bother with converting to full-time equivalents. To meet this objection, Table 3 reports a simple

"head count" of non-managerial workers, and the fraction of such workers who are full-time. Again, however, the fraction full-time increased in New Jersey restaurants while declining in the Pennsylvania sample.¹² The average New Jersey restaurant experienced little change in total employment but one worker was promoted to full-time, while the average Pennsylvania restaurant experienced a loss of almost two full-time workers, again at odds with the rescheduling hypothesis.

On the other hand the simple correlations between the fraction full-time and total employment (however these are measured), calculated separately in each wave in the last two columns of Table 3, do not support the interpretation that these data represent movement along a scheduling isoquant. In the case of Card's and Krueger's definitions, fraction full-time is *positively* correlated with FTE's, in marked contrast to the clear inverse relationship between hours per worker and total employment apparent in Table 1 or Figure 1. For the "head count" definitions, the correlations are small and change sign, surely not suggestive of a scheduling isoquant. Explaining the behavior of the fraction full-time remains an open question, but it does not seem problematic from the perspective of the rescheduling hypothesis maintained in this paper.¹³ If we can learn anything from the mix of full- and part-time workers, it is that fast-food workers are so overwhelmingly part-time (over 70 percent in the combined sample) that rescheduling would not be an unreasonable response to a change in their wage, which is the hypothesis of this paper.

CONCLUSION

How one views the interpretation of the New Jersey natural experiment depends on whether one is primarily interested in its theoretical importance or policy relevance. From the perspective of theoretical relevance, Card's and Krueger's original findings are consistent with heterodox models of the labor market, characterized by imperfect competition, information asymmetries, or other deviations from the standard competitive model, and for that reason they richly deserve the attention they have received. The findings of Neumark and Wascher, as well as the rescheduling hypothesis maintained in this paper, are consistent with the competitive model of the firm. In policy debates, on the other hand, both research teams have been cited by advocates or opponents of the minimum wage, yet it can be argued that whatever the disagreements, their results are both consistent with the conclusion that the New Jersey minimum wage increased the economic well-being of the targeted low-wage workers, at least those in the fast-food industry.

As this paper has tried to clarify, a quite plausible interpretation of the New Jersey experiment is that it resulted in some rescheduling of workers without reducing the overall number of workers on the payrolls of New Jersey fast-food restaurants. Since the proportional reductions in hours per worker were probably smaller than the proportional increases in the wage, the incomes of low-wage workers would have been enlarged by this policy. Hours per worker appear to have declined by around 6 percent, or by about one hour and fifteen minutes per week. One reason to believe that wages rose by more than 6 percent is that the New Jersey legislation, coming soon after an increase in the Federal statutory minimum, affected a substan-

tial proportion of workers in fast-food restaurants and raised the state minimum wage by 17 percent.¹⁴ If the theoretical model that begins the paper is correct and the scheduling isoquant is Cobb-Douglas, the elasticity of weekly hours with respect to the wage is unity and the average worker would have experienced an increase in leisure time with no change in weekly income.

Two admonitions sum up. First, we should be careful about how we use the term "employment" since it can mean the number of workers or total payroll hours. It would not be a freak occurrence for the number of workers and total hours to move in opposite directions while still obeying the laws of algebra. Second, greater efforts to secure data on both the number of workers and their weekly schedules would be helpful in order to make reasonably precise statements about the effects of the minimum wage.

NOTES

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1. I originally advanced this resolution of the apparent conflict in a review [Michl 1996] of Card's and Krueger's book. The current paper represents an attempt to substantiate empirically that early speculation.
2. The Neumark-Wascher data set was obtained at www.econ.msu.edu. The Card-Krueger data set can be obtained through anonymous FTP from the MINIMUM directory at IRS.PRINCETON.EDU.
3. This assumption is fairly standard in the literature on workers and hours. See Feldstein [1967] or Ehrenberg [1971]. For an interesting theoretical approach which nests the scheduling model with monopsony power, see Palley [1995].
4. The restriction that β not exceed unity is necessary for a rising marginal cost in the model developed below. Efficiency wage considerations might also explain this restriction, since a larger workforce is more difficult to supervise.
5. This fixed cost is necessary in order to make the cost function consistent with an initial long run equilibrium having a finite number of firms. It plays no essential role in the argument.
6. For a textbook treatment, see Borjas [1996, 144-147].
7. This statement refers to the employment results in Neumark's and Wascher's work, not their claims about the unreliability of the Card-Krueger data set.
8. Card and Krueger did not collect data on the level of output. They did examine the price effects, with mixed results. Prices rose faster in New Jersey restaurants than in the control group of restaurants in Pennsylvania. See Card and Krueger [1995, 52-56] for detailed discussion.
9. This practice deviates slightly from that of Card and Krueger [1998], who examined this data set as well as their own and chose to average the hours data but not the worker data over the whole month. Card and Krueger generously shared their SAS code with me, so I am reasonably confident of the accuracy of this statement with respect to their methods. Neumark and Wascher [2000] are not explicit about this point. At any rate, nothing substantive rests on these different practices, since the main results below were obtained using both methods.
10. Adding controls for chain (i.e., Burger King or KFC, the only chains in this subset) had no substantive effect on the results in Table 1.
11. Card and Krueger [1999] perform a similar analysis and find that the decline in hours per worker is slightly larger in magnitude. Recall that they have calculated employment in a slightly different way. They also question the quality of the data collected by the Employment Policies Institute, particularly the observations for Pennsylvania restaurants contributed by one Burger King franchi-

see, inferred to be owner 3 in the Neumark-Wascher data set. The results in Table 2 are changed somewhat if this franchisee's restaurants are dropped from the sample, leaving only 26 observations. The log differences in differences for workers, hours per worker, and payroll hours are then 0.112, -0.054, and 0.058 with standard errors of 0.043, 0.043, and 0.035. These results are more favorable to Card's and Kruegers' interpretation of events. The other complaint of Card and Krueger, that differences in payroll periods created measurement errors, cannot be tested in the subsample because there are insufficient data.

12. Card's and Krueger's findings [1995, Table 2.6] for the fraction full-time go through as well for the "head count" definition, with a similar coefficient (8.00) and standard error (4.01). In other words, their finding that there was an increase in the fraction full-time in New Jersey establishments does not seem dependent on their methodology.
13. Of course, these findings do raise the question of how the rescheduling is distributed among the existing workforce. It is still theoretically possible that some workers found their hours so sharply reduced that they experienced a diminution of economic well-being, although how likely this is remains an open question.
14. Even if hours per worker declined by more than wages increased so that a particular worker's income fell, she might still experience a welfare improvement because of the increase in leisure time. During public discussions this elementary but important point is too often forgotten in the heat of debate. Opponents of the minimum wage need to show that not only does it reduce employment enough to lower income, but that it also reduces welfare.

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