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Briefing Paper

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THE MINIMUM WAGE AND JOB LOSS

OPPONENTS OF WAGE HIKE FIND NO EFFECT

by John Schmitt

The minimum wage has found unexpected support in a new quarter. Data from David Neumark and William Wascher, two long-time critics of raising the minimum wage, have vindicated an important study that found that a moderate increase in the minimum wage did not reduce employment.

The original study, by Princeton professors David Card and Alan Krueger,' looked at data from the New Jersey fast-food industry after the state raised the minimum wage in 1992. It received heavy criticism in the spring and summer of 1995 after the Employment Policies Institute, a research organization funded by a cross-section of manufacturers, restaurants, and retailers, charged that Card and Krueger's findings were the product of mistakes in the two economists' data-gathering procedures.[2] The Employment Policies Institute gathered its own data on a small group of fast-food restaurants and made them available to economists Neumark, of Michigan State University, and Wascher, of the Federal Reserve Board. Neumark and Wascher have since evaluated the Employment Policies Institute data, plus a separate sample that the two researchers collected themselves, in three versions of a paper that reexamines the Card and Krueger study.[3] The most recent version, which separately analyzes the Card and Krueger data, the Employment Policies Institute data, and Neumark and Wascher's own data, shows that *the Curd and Krueger data and the Neumark and Wascher data reach the same conclusion: the April 1992 increase in New Jersey's minimum wage did not reduce employment in the state's fast-food industry.* According to Neumark and Wascher's analysis, only the small sample of data obtained by the Employment Policies Institute, using a selection method the organization has not disclosed, indicate a measurable negative effect of the minimum wage on employment.

THE CARD AND KRUEGER STUDY

In September 1994, the *American Economic Review* published the results of a study conducted by Card and Krueger on the effects of the 1992 increase in New Jersey's state minimum wage. Card and Krueger found that the increase, from $4.25 to $5.05 per hour (an 18.8% jump), had no effect on employment in a large sample of the state's fast-food restaurants, a business long thought to be especially sensitive to the level of the minimum wage.[4]

The study received widespread attention, not because its findings were unusual (most studies since the mid-1980s have found that moderate increases in the minimum wage have little or no impact on employment[5]), but because its methodology was so careful and convincing. Card and Krueger surveyed 331 fast-food restaurants in New Jersey and 79 restaurants in eastern Pennsylvania in the two months before the April 1, 1992 increase. They then reinterviewed the same restaurants about eight months later. The study's unique design allowed them to use the restaurants in eastern Pennsylvania, where the minimum wage did not increase, as a control group to gauge the response of the New Jersey restaurants. By comparing changes in employment in the two states (a procedure they referred to as "differences-in-differences"), Card and Krueger were able to estimate the employment effects of the New Jersey increase. Using this approach, they found that the differences in employment growth between the two states were not statistically significant. They concluded, therefore, that the minimum-wage increase did not lower employment in New Jersey.

Card and Krueger also performed a "wage gap" test, which involved comparing employment changes in restaurants with different initial pay rates. They reasoned that, if the minimum-wage hike were adversely affecting employment, then employment would fall more in the restaurants that had to increase pay rates more. As with the better-publicized "differences-in-differences" test, Card and Krueger's "wage gap" test detected no negative effect of the minimum wage on employment.

In addition, the study examined the impact of raising the minimum wage on other aspects of restaurant performance, including potential substitution between full- and part-time employees, wage growth within firms, nonwage compensation, food prices, opening hours, and the rate of new store openings. The analysis of these related issues did not alter their conclusion that the wage increase had no measurable effect on fast-food employment.

THE EMPLOYMENT POLICIES INSTITUTE RESPONSE

In March 1995, Richard Berman, the executive director of the Employment Policies Institute, wrote an op-ed piece for the *Wall Street Journal* charging that Card and Krueger's data were "worse than flawed." His principal criticism was that Card and Krueger's telephone survey produced responses that, he alleged, were "grossly inaccurate."[6] Payroll data that his organization collected from 71 New Jersey and Pennsylvania fast-food restaurants, he said, showed much smaller variations in employment than those implied by Card and Krueger's data.[7,8] Berman argued that since payroll data are inherently more accurate than a telephone survey, economists and policy makers should discard the Card and Krueger results in favor of those obtained with his new data, which, according to Berman, showed that the minimum-

wage increase reduced employment in New Jersey.

Berman's *Wall Street Joumal* piece cited a March 1995 analysis of the Employment Policies Institute payroll data by Neumark and Wascher (1995a), the only researchers so far given access to the data. Neumark and Wascher used the Employment Policies Institute data to replicate some of the statistical tests performed by Card and Krueger. After comparing employment changes in Pennsylvania with those in New Jersey, Neumark and Wascher concluded that the increase in New Jersey's minimum wage had reduced employment in the state's fast-food industry. The results, however, were not statistically well-defined. While the payroll data indicated slower growth in employment in New Jersey relative to Pennsylvania (employment actually increased in both states), the changes were not sufficiently clear-cut to rule out the possibility that the employment differences were due solely to chance.[9] Further, the separate "wage gap" test, which compared employment changes across firms with different initial wage levels, found no significant effect on employment, further undermining the claim that the data showed significant relative employment declines.[10] Overall, following conventional statistical criteria, the Neumark and Wascher results using these Employment Policies Institute data did not differ from Card and Krueger's original findings.[11]

While opponents of the minimum wage, who were less concerned with the fine points of statistical analysis, made a great deal of Neumark and Wascher's research, the study failed to land a blow when judged by the criteria of the economics profession. The fundamental problems with the Employment Policies Institute sample centered on concerns about the validity of the data and the survey methodology used to collect them.

As Neumark and Wascher noted in the second draft of their paper, "[b]ecause the [Employment Policies Institute] has a stake in the outcome of the minimum wage debate...it has been suggested that [it] may have provided us with data that were falsified so as to undermine [Card and Krueger's] results."[12]

Separately, the small sample size-just 71 restaurants, or only about 15% of those in the original Card and Krueger sample frame-raised important questions about the survey method used to collect the data. The Employment Policies Institute did not provide a description of how it identified, contacted, and questioned restaurants in the Card and Krueger sample frame. In the absence of such a description, independent economists could not rule out that problems with "selection bias" or "response bias" might invalidate statistical inferences based on the data. The Employment Policies Institute, for the reasons that Neumark and Wascher alluded to, may have "cherry-picked" restaurants to create a sample where employment increases were large in Pennsylvania and small in New Jersey ("selection bias"). Even filling the sample with restaurants whose owners or managers were simply better known to the surveyors could have inadvertently induced selection bias if these restaurants varied systematically from those not as well known to the Employment Policies Institute. Alternatively, if the Employment Policies Institute did contact most or all of the 473 restaurants in the Card and Krueger sample frame, but received responses from only 80 of these restaurants (versus 410 for Card and Krueger), then the data could suffer from "response bias": those restaurants that chose to respond may have been the ones most negatively affected by the minimum wage, while managers at stores that were not adversely affected may have chosen not to take the time to follow up."

SUBSEQUENT VERSIONS FROM NEUMARK AND WASCHER

To address the credibility of their data and problems stemming from the small sample size, Neumark and Wascher set out to verify the Employment Policies Institute data and, separately, to collect their own payroll data from a larger group of restaurants.[14] They have not, however, reported in any versions of their paper how the Employment Policies Institute chose restaurants for inclusion in its initial sample of 7 I restaurants or in its expanded sample of 80 restaurants used in the August and November versions of their study.

In August 1995, Neumark and Wascher issued a second draft of their paper.[15] This version used the original Employment Policies Institute payroll data combined with newly available information from the Employment Policies Institute on nine additional restaurants plus new data gathered by Neumark and Wascher from another 150 restaurants. Pooled together, these data yielded stronger results than those in the March version. The magnitude of the negative employment effects in the cross-state comparisons (the "differences-in-differences" tests) were similar to those in the first draft, but, with the additional data, the new results were now statistically significant. (The "wage gap" tests, based on different initial wage levels across restaurants, still showed that the minimum-wage increase had no significant effect on employment.[16] Neumark and Wascher write that, "we do not regard our evidence on this point to be as reliable as the direct ['differences-in-differences'] comparisons" because the payroll data did not include information on restaurant starting wages.[17])

In November 1995, however, Neumark and Wascher released a third draft of their paper. This latest account includes important, new details on the expanded data set used in the second draft. The new information raises serious questions about the validity of the data originally supplied by the Employment Policies Institute and directly contradicts the view that Neumark and Wascher's results demonstrate that the New Jersey minimum-wage increase lowered employment.

In the most recent version, Neumark and Wascher reproduce Card and Krueger's original statistical tests separately for a sample of 71 restaurants[18] gathered by the Employment Policies Institute and the full sample of 150 restaurants that Neumark and Wascher collected themselves. The Employment Policies Institute data (see column 1 in the following table) show negative employment effects (-0.95 full-time equivalent workers, or FTEs) that are almost twice as large as in the Neumark and Wascher data (-0.50 FTEs). The Employment Policies Institute estimate, based on data from 71 restaurants, is just shy of being statistically significant (at the 5% level in a two-tailed test). The corresponding estimate from Neumark and Wascher's data, which is drawn from a sample of 150 observations, however, is not statistically significant by any standard. In short, *Neumark and Wascher's larger, independent sample shows a small, negative employment effect that is neither statistically significant nor economically meaningful. With their data, we cannot rule out that chance alone accounts for the differences in employment growth in Pennsylvania and New Jersey."*

Another striking feature of the comparison is that the estimate using Neumark and Wascher's data is *less* statistically significant than the one obtained with the much smaller Employment Policies Insti-

Estimates of Relative Full-Time Equivalent Employment Growth in New Jersey

	Data collected by:	
	Employment Policies Institute (1)	Neumark and Wascher (2)
Coefficient (s.e.)	-0.95 (0. 48)	-0.50 (0.46)
Confidence Interval (95%)	-1.94 to +0.01	-1.41 to +0.41
Number of Restaurants	71	150

Notes:

1. The coefficient and standard error estimates in column 1 are taken from Neumark and Wascher (1995c, Table 7), and represent the estimate of regression-adjusted, relative employment growth in New Jersey based on the averages of available payroll observations.
2. The coefficient and standard error estimates in column 2 are taken from Neumark and Wascher (1995c, 17).
3. The Employment Policies Institute sample used in column 1 excludes data from nine Wendy's company-owned restaurants in Pennsylvania, which Neumark and Wascher omitted from the comparison with their own data since the Employment Policies Institute "obtained data on all of these restaurants" and, therefore, "we cannot do any comparison with the data we collected." (See note to Neumark and Wascher (1995c), Table 7.)
4. It is not possible to calculate corresponding employment-to-minimum-wage elasticities from the information reported in Neumark and Wascher (1995c), since they do not provide mean restaurant employment for these specific samples.
5. The Employment Policies Institute estimate in column 1 is not quite statistically significant at the 5% level using a two-tailed test. The 95% confidence interval calculated in column 1 is the estimated coefficient plus or minus its standard error times $t_{0.975}$ evaluated at the appropriate number of degrees of freedom. In this case, the confidence interval is equal to -0.95 ± (1.99 x 0.48). This range just includes zero.

tute sample. If the two samples were drawn from the same population, the Neumark and Wascher results should be more, not less, significant.[20] Despite the different estimates of the employment effects and their corresponding statistical significance, Neumark and Wascher argue that the two samples can be combined and analyzed as a single data set. The pooling of the two data sets is legitimate, they contend, because the two estimated-employment effects are not statistically different from one another.

This argument, however, is weak. First, it relies on making a virtue out of a vice. It is the relatively large standard errors of the two estimates that allow us to conclude that the estimates themselves aren't significantly different. (We already know that the standard error in the Neumark and Wascher data is large enough to make it impossible to exclude zero as a reasonable estimate of the corresponding employment effects.) Second, and more fundamentally, the decision to combine the two samples relies on a weak statistical test of the comparability of the two data sets. In essence, given the divergent results obtained using the two samples, we would like to know whether the two employment-effect estimates

come from the same underlying distribution. Neumark and Wascher, however, only test whether those distributions have the same mean. Given the central role that Neumark and Wascher and others have attributed to the variances of the distributions,[21] a joint test of whether the two samples have the same mean and variance, or at least a separate test of the equivalency of the variances of the two samples, is stronger and more appropriate. That the standard errors of the employment-effect estimates are very similar across the two samples, despite a doubling of the sample size from one to the other, suggests that the two distributions are not similar. In fact, when we perform a simple statistical test of whether the two samples have the same residual variance (based solely on information presented in the third version of the paper), we conclude that it is most unlikely that the two samples are from the same underlying population. In fewer than one in one hundred cases would we expect to see two samples from the same population with variances that are as different as those in the Employment Policies Institute and Neumark and Wascher samples.[22]

Separately, Neumark and Wascher's "wage gap" tests, even in the pooled data set, continue to find no statistically significant reduction in employment in New Jersey restaurants affected by the minimum wage.[23]

CONCLUSION

The Employment Policies Institute's sampling procedure, which neither the organization nor Neumark and Wascher have outlined, could easily have induced selection or response bias. That results differ so markedly between the Employment Policies Institute sample on the one hand and the samples gathered independently by both Neumark and Wascher and Card and Krueger on the other suggests that the organization's survey method may, in fact, have biased the results obtained. To date, the Employment Policies Institute has not followed through on its commitment, made by Richard Berman last June in the Washington ***Times,*** to make the data available to researchers other than Neumark and Wascher.[24] Until the data and the process used to obtain them are made public, we will not be able to determine what accounts for the widely divergent results obtained using the Employment Policies Institute payroll data.

Basic statistical tests indicate beyond any reasonable doubt that the Employment Policies Institute data differ systematically from those of Neumark and Wascher. This difference raises serious questions about the validity of the Employment Policies Institute data and, therefore, about any judgments reached using them. Neumark and Wascher's conclusion that the 1992 increase in the New Jersey minimum wage reduced employment in the state's fast-food restaurants depends entirely on the 80-restaurant data set supplied by the Employment Policies Institute. The two data sets collected independently of the Employment Policies Institute-Card and Krueger's 4 IO-restaurant sample and Neumark and Wascher's own 150-restaurant sample- both find no evidence that the increase in the New Jersey minimum wage reduced employment in the state's fast-food industry.

ENDNOTES

1. Card and Krueger (1994). This study formed the basis of a chapter in Card and Krueger (1995).

2. See Berman (1995a).

3. Neumark and Wascher (1995a,1995b,1995c).

4. Some on both sides of the minimum-wage debate have claimed that the study finds a positive relationship between fast-food employment and the level of the minimum wage. Card and Krueger's (1994) own reading is that they "find no indication that the rise in the minimum wage reduced employment" (p. 772).

5. See, for example: Wellington (1991); Card (1992a, 1992b); Katz and Krueger (1992); Spriggs and Klein (1994); and Belman and Wolfson (1995).

6. See Berman (1995a).

7. The Employment Policies Institute could not match its sample exactly with restaurants in the original Card and Krueger sample because confidentiality requirements prevented Card and Krueger from providing addresses for individual restaurants. The Employment Policies Institute, therefore, chose restaurants located in the three-digit zip code blocks identified in Card and Krueger's sample.

8. Berman's piece and many others in the business and popular press (see, for example, Paul Craig Roberts (1995)) focused on the high variance in the Card and Krueger telephone survey relative to the payroll data gathered by the Employment Policies Institute and, subsequently, by economists David Neumark and William Wascher. Statistically speaking, however, high variance should not bias the employment estimates in one direction or the other. The very low response rate in the Employment Policies Institute data (about 15% of the 473 restaurants in the Card and Krueger sample frame, in the March version of the Neumark and Wascher paper, rising to 17% for the August and November versions) could, however, have introduced response bias. See Babbie (1973) for a discussion of survey sampling issues.

9. The t-statistic for the estimate of the employment change was -1.75. The critical value for a two-tailed, 5%-significance-level test with 47 degrees of freedom is approximately 2.00. The t-statistic is significant at the 10% level (critical value, approximately 1.67).

10. See Neumark and Wascher (1995a), Table 5. The t-statistic in this test was about - 1 .OO.

11. Neumark and Wascher's (1995a) analysis and two subsequent versions of the paper (1995b,1995c) also suffered from a separate, fundamental, conceptual problem concerning the difference between total employees, total employee-hours, and full-time-equivalent employees. For clarity's sake, here we use Neumark and Wascher's terminology and discuss their data as though it reflected restaurant *employment,* rather than total hours worked in each restaurant in each pay period. The difference is extremely important. Neumark and Wascher's data only speak to changes in total hours worked in each restaurant. Even if their sample were scientifically valid, it would show only that the 18.8% increase in the minimum wage reduced hours worked in the restaurants by 4.6%. A worker moving from the old minimum wage to the new minimum wage would still earn about 14% more per week even after his or her hours were cut by 4.6% (say, from 21 to about 20 hours per week). Card and Krueger collected data on the number of part-time and full-time employees at each restaurant.

12. Neumark and Wascher (1995c, 16).

14. See Babbie (1973) for a discussion of issues in survey methodology.

14. Neumark and Wascher described the procedure they used to check the Employment Policies Institute data in the August version of their paper: "The Employment Policies Institute...was involved in the initial data collection, and supplied us with data on the 71 Burger King and Wendy's franchises used in the earliest version of this study. Because the [Employment Policies Institute] has a stake in the outcome of the mini-

mum wage debate, we took a number of steps to confirm the validity of the data....First, we spoke with each franchise owner who supplied data and verified that they provided numbers from their payroll databases. . ..Second. we requested and received signed statements from each franchisee attesting to the veracity of their data; these statements included a transcription of the actual payroll data....Finally, to protect against the possibility that [the Employment Policies Institute] withheld data on restaurants for which the results were consistent with [Card and Krueger's] results, we contacted every franchisee in the *Chain* Operators *Guide,* to verify that franchisees had not supplied data to the [Employment Policies Institute] which were not subsequently supplied to us" (Neumark and Wascher (1995b, 5).

15. Neumark and Wascher (1995b).

16. See Neumark and Wascher (1995b), Table 5. The t-statistics in the two tests reported are -1.46 and -0.96.

17. Neumark and Wascher (1995b, 16).

18. The Employment Policies Institute provided Neumark and Wascher with data on a total of 80 restaurants. Neumark and Wascher report separate results only for a subsample of 71 of these 80 restaurants. The nine excluded restaurants are Wendy's company-owned stores in Pennsylvania, omitted, according to Neumark and Wascher, because the Employment Policies Institute "obtained data on all of these restaurants" and, therefore, "we cannot do any comparison with the data we collected" (1995c, Table 7).

19. We cannot calculate an exact elasticity from the data provided in the papers because Neumark and Wascher do not directly report mean restaurant employment for any of the subsamples in any of the versions of their paper. By comparison with other elasticity estimates in the final version of the paper, the relative employment change in New Jersey of -0.50 in Neumark and Wascher's own 150-restaurant sample appears to translate roughly to an elasticity of about -0.1. The confidence interval for this estimate includes zero and even positive elasticities. The economic impact on employees of such changes are decidedly positive if the adjustments take place in hours instead of employment. Employees would then work fewer hours per week and receive higher weekly paychecks. See the discussion of Neumark and Wascher's hours data in note 11.

20. More precisely, when the sample size more than doubles (from 71 to 150) the t-ratio in the employment-effects estimates *falls* from just under 2 to just over 1. The expected value, however, of the t-ratio in the 150 restaurant sample is 45% *higher* than in the 71-restaurant sample ($\sqrt{150}/\sqrt{71}$).

21. See Neumark and Wascher (1995a, 5-10); (1995b, 7-12); (1995c, 4-8).

22. The ratio of the residual variances in the two employment-effects estimates, measured by the ratio of each sample size times the corresponding regression standard errors squared, is distributed as an F-statistic under the null hypothesis that the sample variances are identical. From Neumark and Wascher's Table 7 and their text (p. 17), we construct the statistic as: $150*(0.46)^2/71*(0.48)^2 = 1.94$. The probability-value of this F-statistic is 0.003. (For a complete description of the test, see Ott (1977, 346-8).) This test relies solely on information in the tables and text of the third version of the paper. To date, neither the Employment Policies Institute nor Neumark and Wascher have made their data available to the public, despite Richard Berman's promise to do so in the *Washington Times* on June 12, 1995. Access to the Employment Policies Institute and Neumark and Wascher data would allow more careful and comprehensive independent analysis of the Neumark and Wascher findings. Card and Krueger have made their data available to Neumark and Wascher and other investigators. The Card and Krueger data are also available by anonymous ftp through the Internet.

23. See Neumark and Wascher (1995c), Table 5. These results are identical to those in the second draft of Neumark and Wascher (1995b).

24. Berman (1995b), writing in June 1995, urges Card and Krueger "to apply their sophisticated statistical methods to the complete data set of actual payroll records, which will be fully released with the Neumark-Wascher study next month."

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