COMMUNICATIONS

Comment on David Neumark and William Wascher, "Employment Effects of Minimum and Subminimum Wages: Panel Data on State Minimum Wage Laws"

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In their article published in the "Minimum Wage Research Symposium" in the October 1992 issue of this journal (*Industrial and Labor Relations Review,* Volume 45, Number 1, pp. 55–81), David Neumark and William Wascher claim to find empirical support for three propositions: (1) a higher minimum wage leads to a lower teenage employment-population rate; (2) the effect of the minimum wage on employment can be seen within a year, but becomes stronger after two years; and (3) in states with legal subminimum wages, a significant fraction of teenage employees are paid a subminimum wage, and the availability of a subminimum wage blunts the disemployment effect of the minimum wage. The same symposium contains three papers by us that present empirical evidence suggesting conclusions opposite those of Neumark and Wascher.[1] Since Neumark and Wascher's article has been widely cited as supporting the conventional view of minimum wage effects, we believe that a careful evaluation of their empirical analysis is in order.

In this comment we argue that an appropriate analysis of Neumark and Wascher's data raises serious challenges to the conventional view of the minimum wage that they espouse. Indeed, we believe that an objective reading of their data supports the conclusions reached in our papers in the symposium.

Employment Effects

Neumark and Wascher's main empirical strategy is to estimate employment equations of the form

$$(1)\quad E_{it} = \alpha_0 + \alpha_1 MW_{it} + X_{it}\beta + Y_t\gamma + S_i\delta + \varepsilon_{it},$$

where E_{it} is the teenage employment-to-population rate in state i and year t, MW_{it} is a minimum wage index that equals the minimum wage in state i (the maximum of the

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[1]See Katz and Krueger (1992) and Card (1992a, 1992b).

Copies of the computer programs used to generate the results presented in this paper are available from David Card at the Department of Economics, Princeton University, Princeton, NJ 08544.

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state and federal rates) divided by the average wage of adults in the state and multiplied by the coverage rate of the federal minimum wage in the state, X_{it} is a vector of explanatory variables (possibly including the school enrollment rate), Y_t is a set of year dummies, and S_i is a set of state dummies. The model is estimated using state-level observations for the years 1973–89. Neumark and Wascher derive most of their data directly from May Current Population Survey (CPS) files for these years.

Neumark and Wascher's conclusions hinge entirely on whether they hold constant the effect of a variable reportedly measuring "the proportion of the age group enrolled in school." When they include this variable, the minimum wage index has a statistically significant negative effect on employment. When they exclude this variable, however, the minimum wage index has a statistically insignificant and positive contemporaneous effect on teenage employment. Moreover, when they exclude this variable, the minimum wage has a statistically insignificant effect on teenage employment, even if lagged effects of the minimum are taken into account (see Neumark and Wascher's Table 5, columns 1–4).

Neumark and Wascher generously provided us with their data. We have replicated their results for teenagers in the first two columns of Table 1. Inspection of their data revealed that the mean of the critical school enrollment variable is only 40%—far lower than any estimate of the teen enrollment rate for May. David Neumark informed us that the variable they refer to as the "proportion of age group in school" is calculated so as to exclude from the "enrolled" group any teenager who is working, even part-time.[2] The problem stems from the fact that Neumark and Wascher calculated both the employment and school enrollment rates from the "Employment Status Recode" (ESR) variable on the CPS files. The ESR is primarily designed to measure employment and unemployment. According to the ESR variable, anyone who worked even one hour in the survey week is coded as employed, regardless of that person's school enrollment status. It is inappropriate and misleading to call Neumark and Wascher's enrollment measure the "proportion of age group in school." Rather, it measures the proportion who are not working and are enrolled in school.

Beginning in 1986, the CPS asked all respondents who were between 16 and 24 years of age a question on school enrollment status. Responses to this question allow us to calculate true enrollment status independent of labor force status. Using a sample drawn from the May 1988 CPS, we calculate that 75% of teenagers were then enrolled in school. The percentage is only slightly lower for teenagers in the labor force: in May 1988, fully 65% of teenagers who worked were also enrolled in school. Neumark and Wascher's enrollment measure clearly is based on a false dichotomy. Not only may teenagers who work also be enrolled in school, but they usually are. Far from being mutually exclusive activities, schooling and work go hand-in-hand for most teenagers.

The misdefined enrollment variable causes a major problem for Neumark and Wascher's analysis: the dependent variable in their analysis (the employment-population rate) and the key independent variable (the enrollment rate) are mechanically related by construction. Sampling errors in the state-specific teenage employment rate, which are typically large, automatically enter into their enrollment measure with an equal and opposite effect. As a result, *Neumark and Wascher effectively have regressed the employment rate plus some noise on one minus the employment rate plus some noise.* This procedure will naturally lead to a coefficient on their enrollment variable that is biased toward –1.

Because Neumark and Wascher regress the employment-population rate on an enrollment measure that is mechanically correlated with the employment rate, they find a t-statistic of over 25 on the enrollment variable. By contrast, the next highest t-ratio for

[2]For most of the years they examine, the school enrollment rate cannot be calculated from May CPS files. State-specific school enrollment rates could be calculated, however, from October CPS files or from administrative data.

Table 1. Regression Models for State-Level Teenage Employment Rates and Average Wages. (Standard Errors in Parentheses)

	Teen Employment-Population Rate				*Log of Average Teenage Wage Rate*			
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
1. Coverage-Adjusted Relative State Minimum Wage[a]	0.07 (0.10)	–0.17 (0.07)	—	—	–0.88 (0.22)	–0.88 (0.22)	—	—
2. Log of State Minimum Wage[b]	—	—	0.16 (0.08)	0.04 (0.05)	—	—	0.63 (0.18)	0.64 (0.18)
3. Fraction of Teens in School and Not Working[c]	—	–0.75 (0.03)	—	–0.74 (0.03)	—	–0.01 (0.09)	—	0.05 (0.09)
4. Proportion of Teens in State Population	–0.19 (0.22)	–0.11 (0.15)	–0.16 (0.22)	–0.14 (0.15)	–0.54 (0.49)	–0.53 (0.49)	–0.65 (0.49)	–0.65 (0.49)
5. Prime-Age Male Unemployment Rate	–0.54 (0.10)	–0.31 (0.07)	–0.52 (0.11)	–0.32 (0.07)	–0.80 (0.24)	–0.80 (0.24)	–0.80 (0.24)	–0.82 (0.24)
6. State and Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7. R-squared	0.72	0.87	0.72	0.87	0.77	0.77	0.77	0.77

Notes: All models are fit to a sample of 751 state-year observations. In columns 1–4, the dependent variable is the employment-population rate for teenagers in the state in May, and the mean and standard deviation of the dependent variable are 0.432 and 0.090, respectively. In columns 5–8, the dependent variable is the log of the average hourly wage of teenagers in the state in May, and the mean and standard deviation of the dependent variable are 1.267 and 0.225, respectively.

[a]Maximum of state-specific or federal minimum wage, divided by average wage of adults in the state and multiplied by the estimated fraction of workers in the state covered by the federal minimum wage.

[b]Log of maximum of state-specific or federal minimum wage.

[c]Fraction of teenagers in state not working (in May CPS survey week) and in school.

any variable in their regressions is just over 4. Although the extraordinarily high t-ratio for the enrollment variable is a clear signal of potential misspecification, Neumark and Wascher base their conclusions on specifications that include the mismeasured enrollment variable.[3]

We believe that this specification makes little sense even if the enrollment variable is properly measured. Neumark and Wascher's estimating equation is essentially an employment demand equation, and they interpret the effect of a rise in the minimum wage as a movement along the demand curve. In a properly specified supply-demand model, supply-side variables such as the enrollment rate do not belong in the demand equation, once the market wage is included.[4] Researchers in previous studies have not included the school enrollment rate in their "preferred" specifications (see Brown et al. 1982). Moreover, a large literature examines the effect of the minimum wage on school enrollment (see, for example, Ehrenberg and Marcus 1982).

We emphasize that when the mismeasured school enrollment variable is excluded from Neumark and Wascher's equations, they find that an increase in the minimum wage has no significant effect on employment, and may even lead to an increase in teenage employment.

[3]We should point out that in a subsequent paper Neumark and Wascher (1993) estimate the same model using the same data, but treat their "enrollment rate" variable as endogenous. That approach does not solve their problem, because the employment equation is misspecified if it includes the improperly measured enrollment rate.

[4]In a competitive market, the wage is a sufficient statistic for all supply-side variables that are excluded from the market demand function.

Problems of Minimum Wage Measure and Specification

We have uncovered additional problems in Neumark and Wascher's specification and data. Most important, the conventional model of the minimum wage predicts that a rise in the minimum will reduce employment because a higher minimum raises wages. If the demand curve for labor slopes down, and employment is determined by the demand curve, then an increase in the minimum will reduce employment only in so far as it raises wages. Thus, for Neumark and Wascher's results to be interpreted as support for the conventional model, it is critical that their minimum wage index have a positive association with the average wage of teenagers. Remarkably, this is not the case. Columns 5 and 6 of Table 1 report regressions using the average wage of teenagers as the dependent variable and Neumark and Wascher's minimum wage index as an explanatory variable. Increases in the minimum wage index are associated with lower wages, and the t-ratio for this effect is –4.

The average teenage wage was calculated by Neumark and Wascher from May CPS files. Although the estimated teenage wage is based on a relatively small number of observations in some states, the seemingly perverse finding that an increase in the minimum wage index is associated with lower wages cannot be dismissed as a result of sampling errors. When the teenage wage is the dependent variable, random sampling errors only affect the precision of the estimated equation. Moreover, the wage equations have relatively high R-square coefficients (77%), suggesting that measurement error in the teenage wage is not a serious problem.

Why do Neumark and Wascher find that the minimum wage index is negatively associated with teenage wages? The answer is that the denominator of their index is the average wage of adults in the state. States that have high adult wages tend to have high teenage wages, and states in which the adult wage is rising also tend to be states in which the teenage wage is rising. This phenomenon causes the teenage wage and minimum wage index to be negatively correlated, and this negative correlation outweighs any positive correlation between the minimum wage and the average wage of teenagers in the state.[5]

What is one to make of this result? Literally interpreted, Neumark and Wascher's results indicate that demand curves slope up, not down. But the minimum wage index is arguably not an exogenous variable in their models, because the factors that cause adult wages to rise in a state may also cause teen employment to grow. As a consequence, it is better to use the minimum wage itself as an exogenous shifter of wages, rather than the index. And it can be seen in columns 7 and 8 of Table 1 that the minimum wage is positively associated with teen wages in the state, as one would expect.

In columns 3 and 4 of Table 1 we include the minimum wage itself, rather than the minimum wage index, in the employment equation. Contrary to Neumark and Wascher's conclusion, these results show that a higher minimum wage is associated with higher teenage employment. And this effect is statistically significant in column 3. If the inappropriate school enrollment variable is included, the effect of the minimum wage on employment continues to be positive, not negative, but is no longer statistically significant.

In defense of the minimum wage index, one can argue that the demand for teenage employees in a state depends on their wage relative to the wage of other workers. This consideration suggests that the average wage of adult workers should be included in the teenage employment models.[6] We have re-estimated the models in columns 3 and 4 including the log of adult wages in the state as an additional covariate. In each case this variable has a numerically small and statistically insignificant coefficient. For example,

[5]The previous time-series literature on minimum wage effects has also focused on reduced form estimates that include a similar minimum wage index. These studies may suffer from the same problem.

[6]Neumark and Wascher's specification imposes the restriction that teenage employment has equal and opposite elasticities with respect to teen and adult wages.

the coefficient is –0.03 (with a standard error of 0.04) in the specification of column 3. Furthermore, the addition of the adult wage has no effect on the estimated minimum wage coefficient.

We have also used Neumark and Wascher's data to obtain structural estimates of the elasticity of demand for teenage employment. Specifically, we regress teenage employment rates on the average teenage wage and use the minimum wage as an instrumental variable for the average wage of teenagers in the state.[7] Instrumental variables estimates of the employment demand elasticity are presented in Table 2. The conventional model predicts a negative coefficient. By contrast, the base specification has a positive elasticity (0.25) and is nearly statistically significant at conventional significance levels.

Most of Neumark and Wascher's analysis is performed without weighting the state-level observations by the size of the state. We believe that an argument can be made for weighting, so we have also calculated weighted estimates.[8] When the full sample is used, the estimated elasticity is negative, but statistically insignificant and small. If we estimate separate models using data from before and after 1982, we find a positive elasticity in the early years and a negative one in the later years. But in each case the estimate is statistically indistinguishable from zero.

Neumark and Wascher estimate teenage employment rates from the May CPS, resulting in imprecise estimates for many smaller states. More precise estimates of the employment-to-population ratio for teenagers are available (after 1979) from the BLS publication *Geographic Profiles of Employment and Unemployment,* based on all 12 monthly CPS surveys in each year. In column 2 of Table 2 we present estimates of the employment demand elasticities using the more precise an-

Table 2. Instrumental Variables Estimates of Alternative Models for the Teenage Employment-Population Rate. (Standard Errors in Parentheses)

	Choice of Dependent Variable:	
Sample and Weighting Procedure	*Neumark-Wascher Estimate of Emp/Pop*[a] *(1)*	*Published Annual Emp/Pop*[b] *(2)*
1. Base Specification (1973–89, unweighted)	0.25 (0.14)	—
2. 1973–89, weighted	–0.09 (0.10)	—
3. 1973–82, unweighted	1.53 (1.27)	—
4. 1973–82, weighted	0.89 (0.91)	—
5. 1983–89, unweighted	–0.10 (0.15)	–0.02 (0.07)
6. 1983–89, weighted	–0.11 (0.10)	0.00 (0.05)

Notes: Sample consists of state-year observations from 1973–89 for 22 states (including District of Columbia) and from 1977–89 for 29 other states. The table entries are instrumental variables estimates of the coefficient of average teenage wages in a model for the teenage employment rate. The instrument in every case is the maximum of the state and federal minimum wages for the state and year. All first- and second-stage models include state and year effects, the fraction of teenagers in the state population, and the unemployment rate (of prime age men in column 1, of all workers in column 2). Weighted models are weighted by an estimate of the state population in the relevant year.

[a]The dependent variable is the estimated teenage employment-population rate for May. The (unweighted) mean and standard deviation of the dependent variable are 0.432 and 0.090.

[b]The dependent variable is the average annual teenage employment-population rate for the state, taken from *Geographic Profiles of Employment and Unemployment,* 1983–89 issues. The (unweighted) mean and standard deviation of the dependent variable are 0.466 and 0.084.

[7]The models control for the variables in Neumark and Wascher's base specification (including state and year effects). The coverage rate of the federal minimum wage could be used as another instrument, but as explained below, this variable is seriously mismeasured in Neumark and Wascher's data.

[8]If the main source of variability in the employment equation is sampling error in the underlying employment-population rates, then efficient estimates are obtained by weighting the regression by the inverse sampling variances of the state estimates. These variances are roughly proportional to the state populations.

nual employment rates. In these specifications we have also replaced Neumark and Wascher's estimate of the male unemployment rate in the state with the overall annual unemployment rate for the state, obtained from the same source.[9] Using the more precise data, we find that the weighted elasticity estimate is zero and the unweighted estimate is small and negative. It should be stressed that these estimated coefficients are relatively precise, with a standard error of 0.05 in the weighted model.

It is also of interest that Neumark and Wascher's key enrollment variable has one-fifth as large an effect when it is included on the right-hand-side of an equation that uses *Geographic Profile*'s data on the employment-to-population rate as the dependent variable. The reason the enrollment variable matters so much less in this specification than in Neumark and Wascher's specification is that the estimates of employment and enrollment are now derived from samples with little overlap. This result is further evidence that the strong negative coefficient of the enrollment variable in Neumark and Wascher's models is mechanically driven by sampling error in their estimated employment rate.

Coverage Variable

The other element of Neumark and Wascher's minimum wage index is the adjustment for coverage. Their coverage adjustment is based on published Bureau of Labor Statistics estimates of the fraction of nonsupervisory workers in each state covered by the federal minimum wage law. There are two deficiencies in this coverage measure. First, the coverage rate is for *all* workers, whereas Neumark and Wascher's data pertain to teenagers and 20–24-year-olds. Second, the coverage measure makes no allowance for state minimum wage laws, which greatly expand the coverage of minimum wage statutes in many states.

The net effect of these deficiencies is illustrated in Figure 1, in which we have plotted aggregate teenage employment-population rates for the United States from 1975 to 1989, along with a predicted teenage employment rate from a simple linear regression on a time trend and the aggregate employment-population rate.[10] We have also plotted the overall coverage rate of the minimum wage, based on a population-weighted average of Neumark and Wascher's coverage rates across states. Because of a legal ruling, coverage of the minimum wage was extended to the public sector in 1985, and Neumark and Wascher's data show a 9 percentage point (or 13%) increase in coverage in 1985. According to their methodology and preferred estimates, this expansion of minimum wage coverage should have lowered teenage employment rates by 1.3 to 2.6 percentage points starting in 1985.[11] Examination of Figure 1, however, shows no downturn in teenage employment rates relative to predictions based on trend and aggregate employment patterns.

If one accepts Neumark and Wascher's coverage-weighted minimum wage index as an appropriate measure, the 1985 expansion in coverage is an ideal "natural experiment" for evaluating the effect of minimum wages. The experiences following this "natural experiment" suggest that either the minimum wage has no effect, or the coverage-weighted index is an inappropriate measure.

Re-examination of the 1990 Increase in the Federal Minimum Wage

Card's (1992a) analysis of the April 1990 rise in the federal minimum wage seems to

[9]These changes raise the R-squared coefficients from 0.74 to 0.93. It should be noted that the minimum wage variable is not perfectly aligned with annual observations. Since this variable is used as an instrument, however, the misalignment is not a problem.

[10]The same series are shown in Card (1992a), Figure 2.

[11]Neumark and Wascher state in their conclusion (page 78) that a 10% increase in the coverage-weighted relative minimum wage will lower teenage employment by 1 to 2 percentage points.

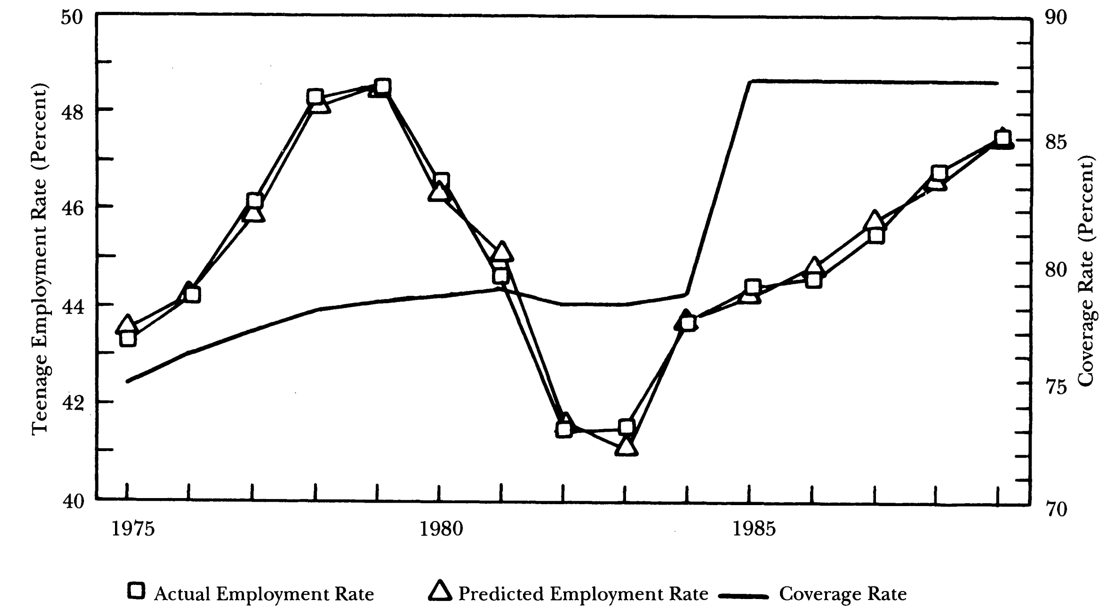

Figure 1. Teenage Employment Rates and Coverage Rate of the Federal Minimum Wage, 1975–89.

directly contradict Neumark and Wascher's conclusion that an increase in the minimum wage will lower teenage employment. Based on our re-analysis of Neumark and Wascher's data, we believe that their conclusion is incorrect. Neumark and Wascher, however, attribute the different conclusion to two shortcomings in Card's (1992a) specification: failure to control for school enrollment, and failure to allow for lagged effects of the minimum wage.[12] To address these criticisms, we re-examined the employment and wage models in Card (1992a) using an extra year of data and controlling for differences across states in the *true* school enrollment status of teenagers. The results are presented in Table 3.

The specifications follow Card's Table 3. The dependent variables are the change in mean log wages of teenagers in a state and the change in the teenage employment-to-population ratio in a state.[13] In our re-analysis, however, we use the change between 1989 and 1991, allowing over a year for employment adjustments to take place after the rise in the federal minimum wage in April 1990. The federal minimum wage rose again on April 1, 1991 (to $4.25 per hour). Thus, our 1991 data incorporate a full one-year lagged effect of the 1990 increase, as well as the immediate impact of the 1991 increase.

As in Card (1992a), we measure the impact of the minimum wage by the fraction of teenagers in the state in 1989 who were earning $3.35 to $3.79 per hour (the "affected" wage range). This measure has several advantages over the coverage-weighted minimum wage index used by Neumark and Wascher.

[12]These criticisms were echoed in a report by Neumark (1993) published by the Employment Policies Institute.

[13]Both outcomes are measured using data for April–December of each year, because the minimum wage increase took effect on April 1.

Table 3. Estimated Regression Models for State-Average Changes in Wages and Employment Rates of Teenagers, 1989–91. (Standard Errors in Parentheses)

	Equations for Change in Mean Log Wage			*Equations for Change in Emp/Pop Rate*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1. Fraction of Affected Teens	0.29 (0.04)	0.24 (0.04)	0.24 (0.04)	0.13 (0.04)	0.04 (0.04)	0.04 (0.03)
2. Change in Overall Emp/Pop Ratio	—	1.03 (0.41)	1.06 (0.43)	—	1.69 (0.44)	1.64 (0.47)
3. Change in Teen Enrollment Rate	—	—	0.03 (0.12)	—	—	–0.05 (0.13)
4. R-squared	0.57	0.62	0.62	0.15	0.35	0.35

Notes: Estimated on a sample of 51 state observations. Regressions are weighted by the average CPS extract sizes for teenage workers in each state. All regressions include an unrestricted constant. The mean and standard deviation of the dependent variable are .090 and .059 in columns 1–3 and –0.051 and 0.049 in columns 4–6.

Most important, it automatically accounts for interstate variation in the distribution of teenage wages. In states where average teenage wages are relatively high, the estimated fraction of affected teenage workers is appropriately low.

Inspection of the coefficient estimates in columns 1–3 of Table 3 shows that the rise in teenage wages between 1989 and 1991 was significantly greater in states with a relatively high fraction of teenagers in the affected wage range in 1989 than in other states. States with a higher fraction of affected teenage workers also had slightly greater employment growth between 1989 and 1991, even controlling for the overall employment rate in the state (column 5).

Column (6) shows that augmenting the employment model with the change in the true enrollment rate of teenagers has no effect on inferences about the employment effect of the minimum wage. Thus, contrary to the assertions of Neumark and Wascher, allowing for lags and controlling for enrollment does not reverse the original conclusion in Card (1992a). Indeed, employment changes between 1989 and 1991 are more positively correlated with the fraction affected variable than the short-run changes between 1989 and 1990, although in no case are the coefficients statistically significant.

Subminimum Wage

Neumark and Wascher claim to find evidence that states with subminimum wage provisions for teenage workers have higher teenage employment rates than states without such provisions. Their evidence comes from interacting their minimum wage index with a dummy variable indicating whether a state allows a subminimum wage for youths or students. These equations are misspecified and unreliable for reasons described above. Furthermore, their conclusion is implausible given the overwhelming evidence that few employers take advantage of youth subminimum wages when they are permitted to do so.

Neumark and Wascher claim that the "research on the subminimum is in its infancy, and a definitive answer [on the usage rates of subminimum wages] awaits further research." This assertion ignores a substantial body of evidence that consistently finds extremely low usage of the subminimum wage. Freeman, Gray, and Ichniowski (1981) found that only 3% of students' work hours were covered by the subminimum wage permitted for full-time students in the late 1970s. Katz and Krueger (1992) found that less than 4.8% of Texas fast-food restaurants used the youth subminimum wage in 1991. Spriggs et al. (1992) found that less than 2% of fast-food restaurants in Mississippi and North Carolina used the subminimum wage. A nonrandom survey of restaurants by the National Restaurant Association found that only 8% of restaurants had used the youth subminimum.[14] Katz and Krueger (1991) found that the introduction of the youth subminimum in 1990 had no discernible effect on teenage workers' wages. And perhaps most definitively, a U.S. Department of Labor study based on the Wage and Hour Survey found that only 1% of all employers used the federal subminimum wage, and only 2% of employers who paid at least one worker the minimum used the subminimum.[15]

Neumark and Wascher (p. 78) claim to show that subminimum wage provisions are used enough to have a real impact on teenage employment, but a closer examination of their evidence suggests just the reverse. Their evidence comes from an analysis of spikes in the wage distribution around state subminimum wage levels in 12 states that allowed subminimum wages in 1989. They acknowledge that 9 of the 12 states displayed *no spike* at the subminimum. Two of the remaining states had small spikes at the state subminimum, which coincided in each case with the federal minimum wage of $3.35. Neumark and Wascher note that these small spikes could have resulted from employers who are covered by the federal minimum wage but uncovered by the state minimum. Since we find a spike at $3.35 per hour in the wage distributions for senior citizens in some of these states, we suspect that this result is not strong support for the proposition that the subminimum wage is widely used.

The only other state that shows a spike is Minnesota, which had a subminimum of $3.47. Neumark and Wascher (p. 78) argue that "the spike for Minnesota is particularly noteworthy" because it is at a wage level above the federal minimum rate. We have reexamined this spike using the same data as Neumark and Wascher. It turns out that only one Minnesota teenager was paid the subminimum wage of $3.47 in the 1989 CPS file.[16] Why does Neumark and Wascher's histogram show a spike at $3.47? The answer is that Neumark and Wascher's "wage intervals" (the intervals of wages that they graph separately) include $3.50 in the subminimum cell. In Minnesota, as in many other states, there is a spike in the wage distribution at $3.50 per hour. On balance, Neumark and Wascher's evidence on the use of the subminimum wage is consistent with that of previous studies, which indicate that only a trivial fraction of employees actually receive the subminimum wage.

Finally, it is worth reiterating that Neumark and Wascher find no spike at the subminimum wage for teenagers in three-quarters of the states they examine. They explain this finding by the fact that average teenage wages are relatively high in these states, so that the market wage exceeds the subminimum. If that is true, however, then in most states it is impossible for the subminimum wage to have any effect on teenage employment rates.

Conclusion

We have identified three flaws in Neumark and Wascher's empirical analysis. First, because of data limitations, the school enrollment variable they use is seriously mismeasured. Neumark and Wascher's enrollment variable is predicated on the incorrect assumption that teenagers either work or attend school. In fact, most teenagers who work also attend school. Empirical estimates based on the use of this enrollment variable are misspecified.

Second, Neumark and Wascher measure the effect of the minimum wage by a coverage-weighted relative minimum wage index. This variable is negatively correlated with the wage of teenage workers. Taken literally, Neumark and Wascher's results show that a rise in the relative minimum wage lowers teenage wages. We use their data and other more precise state-level data to estimate the effects of state minimum wage rates on teenage wages and teenage employment rates.

[14]See Bureau of National Affairs (1993).

[15]The same study found that only 4.7% of retailers used the subminimum, very close to Katz and Krueger's (1992) estimate. Results from the Department of Labor study are reported in BNA (1993).

[16]This individual, who was employed in the eating and drinking industry, actually earned $6.00 per hour if tips are counted.

We find that an increase in the state minimum wage raises average teenage wages, but it has insignificant employment effects that vary in sign and average close to zero.

Finally, a re-analysis of Neumark and Wascher's evidence shows that state subminimum wage provisions are rarely (if ever) used. Given this evidence, and a significant literature on the low utilization rate of the federal subminimum, Neumark and Wascher's conclusion that these provisions have significant employment effects is implausible.

We also address the criticisms that Neumark and Wascher directed at Card's (1992a) study of the April 1990 rise in the federal minimum wage. Neumark and Wascher claim that Card's conclusions are biased because Card failed to control for school enrollment and did not consider the lagged effect of the law. Contrary to these claims, the introduction of controls for enrollment status and the allowance for lags actually strengthen, rather than reverse, the conclusions in Card's study.

In summary, a corrected analysis of Neumark and Wascher's data shows that state-specific minimum wage increases during the 1970s and 1980s had no systematic effect on teenage employment. Taken together with the evidence in our studies in the Minimum Wage Research Symposium, and with the evidence in Card and Krueger (1993), the interstate patterns of teenage employment rates in Neumark and Wascher's data challenge the conventional view that higher minimum wages lead to measurable reductions in teenage employment. The consistency of this conclusion across different data sets, time periods, and minimum wage increases suggests to us that economists may need to reevaluate their models of the low-wage labor market. A growing body of research emphasizes such frictions as mobility costs, firm- and worker-specific "match quality," and efficiency wages in understanding the market for more highly skilled workers. Perhaps it is time for a serious consideration of these same factors in models for the less-skilled segment of the labor market.

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Employment Effects of Minimum and Subminimum Wages: Reply to Card, Katz, and Krueger

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In the October 1992 issue of this journal (Neumark and Wascher 1992), we presented findings supporting the earlier consensus that minimum wages reduce employment for teenagers and young adults, with elasticities in the range –0.1 to –0.2. In addition, we found that subminimum wages moderate these disemployment effects. Although our results on minimum wage effects generally conformed with the results of earlier research, they contrasted with some recent studies that found little or no effect of minimum wages on employment, or even positive effects.[1] In their comment, Card, Katz, and Krueger (hereafter CKK) challenge our results. They group their criticisms of our paper into five categories, relating to our inclusion and measurement of school enrollment rates, our measurement of the coverage rate, our specification of the minimum wage variable, the role of lagged minimum wage effects, and evidence on the use of subminimum wages.

Because research on minimum wages is likely to influence policy decisions, efforts to sort out the conflicting evidence are important. (In addition to this exchange, see Currie and Fallick 1993.) Some aspects of our exchange with CKK may prove useful in those efforts. We do not believe, however, that CKK's evidence or arguments alter the conclusions from our original paper.

Enrollment Rates

The first question CKK raise regarding the enrollment rate is whether it should be included in the employment equation. CKK argue that we are estimating an employment demand equation, and that it is "far from clear that supply-side variables, such as the enrollment rate, belong in this equation." They cite the Brown et al. (1982) survey as evidence that researchers have not included the school enrollment rate in their preferred specifications.

[1]See Wellington 1991; Card 1992a, 1992b; Spriggs 1992; Katz and Krueger 1992; and Card and Krueger 1993. On the other hand, Taylor and Kim (1993) reported large disemployment effects in retail trade, and Williams (1993) found disemployment effects in some regions of the United States.

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