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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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We thank David Neumark and William Wascher for providing their data. The views expressed in this paper are solely those of the authors and do not reflect the position or opinion of the U.S. Department of Labor or the U.S. government.

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ABSTRACT

We re-examine the evidence presented by Neumark and Wascher (1992) on the employment effect of the minimum wage. We find three critical flaws in their analysis. First, the school enrollment variable that plays a pivotal role in their specifications is derived on the false assumption that teenagers either work or attend school. Measurement error biases contaminate all the empirical estimates that use this enrollment variable.

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 average teenage wages. Taken literally, their results show that a rise in the coverage-weighted relative minimum wage lowers teenage wages. Examining the direct effects of state-specific minimum wages, we find that increases in state minimum wages raise average teenage wages but have essentially no employment effects.

Finally, a careful analysis of Neumark and Wascher's data shows that subminimum wage provisions are rarely used. This casts doubt on their claim that subminimum provisions blunt any disemployment effect of the minimum wage.

Neumark and Wascher contend that other minimum wage studies are biased by failing to control for school enrollment, and by failing to consider the lagged effects of minimum wages. We re-analyze the experiences of individual states following the April 1990 increase in the Federal minimum wage, allowing for a full year lag in the effect of the law and controlling for changes in (properly measured) enrollment rates. Contrary to their claims, allowing for lagged effects and controlling for enrollment status actually strengthens the conclusion that the 1990 increase in the Federal minimum had no adverse employment effect.

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In their article published in the "Minimum Wage Research Symposium" in the October 1992 issue of the Industrial and Labor Relations Review (Volume 45, Number 1, pp. 55-81), David Neumark and William Wascher claim to find empirical support for three conclusions: (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; (3) a significant fraction of teenage employees are paid a subminimum wage when state laws permit employers to do so, and the availability of a subminimum wage blunts the disemployment effect of the minimum wage. The same Symposium published three papers by us that present empirical evidence suggesting opposite conclusions to Neumark and Wascher's.¹ Since Neumark and Wascher's article has been widely cited in the press and elsewhere as supporting the conventional view of a minimum wage, we believe a careful evaluation of their statistical analysis is in order.

In this comment we show 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, an objective reading of their data provides strikingly strong support for our own findings published in the Symposium.

Employment Effects

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

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

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

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 (the maximum of the state and federal rates) divided by the average wage of adults times the coverage rate 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, S_i is a set of state dummies. The model is estimated using state level data for the years 1973-89. Neumark and Wascher derived most of their data directly from May Current Population Survey (CPS) files.

Neumark and Wascher's results hinge entirely on whether they hold constant the effect of a variable reportedly measuring "the proportion of the age group enrolled in school." If they do include this variable, the minimum wage index has a statistically insignificant and positive contemporaneous effect on teenage employment; if they do include this variable the minimum wage index has a statistically significant, negative effect on employment. Moreover, according to their results (Table 5, columns 1-4), if this variable is omitted the minimum wage has a statistically insignificant effect on teenage employment, even if lagged effects of the minimum are taken into account.

Neumark and Wascher were kind enough to provide us with their data. We have replicated their results for teenagers in the first two columns of Table 1. After inspecting their data, we were surprised to learn that the mean of the variable they call "the proportion of age group in school" was only around 40%. This is far lower than any estimate of the teen school enrollment rate. David Neumark informed us that the variable they call "proportion of age group in school" was actually calculated in such a way as to exclude anyone who is working, even part time, from the enrollment

rate.² The problem stems from the fact that Neumark and Wascher calculated both the employment and school enrollment variables from the "Employment Status Recode" (ESR) variable on the CPS files. The ESR variable is primarily designed to measure employment and unemployment. According to the ESR variable, any individual who worked one hour or more in the survey week is coded as employed, regardless of their 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 not working (or unemployed) and enrolled in school. In fact, most teenagers who work (or look for work) are also enrolled in school.

Beginning in 1986, the CPS asked a separate question on school enrollment status to all individuals age 16-24. This allows us to calculate the true school enrollment rate. Using a sample drawn from the 1988 Outgoing Rotation Group File for the month of May, we calculate that 75% of teenagers are enrolled in school. The percentage is only slightly lower for teenagers in the labor force. Fully 65% of teenagers who work are also enrolled in school. Neumark and Wascher have established a false dichotomy -- not only is it possible for teenagers who work to be enrolled in school, it is the most common outcome. Far from being mutually exclusive activities, schooling and work go hand-in-hand for most teenagers.

Misdefining the enrollment variable causes a major problem for Neumark and Wascher's analysis: the dependent variable in their analysis (the

²For 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 from October CPS files or from administrative data, however.

employment-population rate) and the key independent variable (the enrollment rate) are mechanically related by construction. Sampling error in the state-specific teenage employment rate (these sampling errors are typically large) automatically enters 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 will naturally lead to a coefficient on their enrollment variable that is biased toward -1.

Because Neumark and Wascher have regressed the employment-population rate on a variable that is approximately 1 minus the employment rate, they find a t-statistic of over 25 on the enrollment variable. By contrast, the next highest t-ratio for any variable in this regression is just over 4. A t-ratio of 25 should send up warning flags that something is amiss!

Neumark and Wascher ignore these flags. Their "preferred" specification includes the enrollment variable.³ We believe this would make little sense even if the enrollment variable were properly measured. The equation they estimate 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. It is far from clear that supply-side variables, such as the enrollment rate, belong in this equation. If the past literature is any guide, researchers have not included the school enrollment rate in their "preferred" specifications (see Brown, et al.

³We 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. This does not solve their problem because the employment equation is mis-specified if it includes the improperly measured enrollment rate.

(1982)). Moreover, a large literature exists examining the effect of the minimum wage on school enrollment (e.g., Ehrenberg and Marcus (1982)).

It is worth stressing that when the inappropriate school enrollment variable is left out of Neumark and Wascher's equations, they find that a higher minimum wage has no significant effect on employment, and may even lead to an increase in teenage employment.

Problems of Minimum Wage Measure and Specification

We have uncovered additional problems in Neumark and Wascher's specification and data. Most importantly, the conventional model of the minimum wage predicts that a rise in the minimum will have a negative effect on employment because a higher minimum raises labor costs. 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 if it increases 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 2 report regression using the average wage of teenagers as the dependent variable. Increases in the minimum wage index used by Neumark and Wascher 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 effect the precision of the estimated equation. Moreover, the wage equations have relatively high R-squares (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 where 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 teens in the state.⁴

What is one to make of this result? A literal interpretation of Neumark and Wascher's results is that they find that demand curves slope up, not down. But the minimum wage index is arguably not an exogenous variable in their models because the forces 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 Column 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 directly in the employment equation instead of the minimum wage index. Contrary to

⁴The previous time-series literature on minimum wage effects has also focused on reduced form estimates that include a similar minimum wage index. We conjecture that these studies may suffer from the same problem.

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.

We have also investigated structural estimates of labor demand curves for the minimum wage using Neumark and Wascher's data. Specifically, we use the minimum wage as an instrument for the average wage of teenagers in the state, and control for the variables in Neumark and Wascher's base specification (including state and year effects).⁵ 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 (.25), which is nearly statistically significant.

Neumark and Wascher's analysis is mostly done without weighting the state-level observations by the size of the state. We believe an argument for weighting can be made, so we have also calculated weighted estimates.⁶ 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

⁵The coverage rate could also be used as an instrument, but as explained below this variable is seriously mismeasured in Neumark and Wascher's data.

⁶If 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 are roughly proportional to the state populations.

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 their employment-to-population ratios from the May CPS, which yields 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 annual 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.⁷ Using the more precise data we find that the weighted elasticity estimate is zero while the unweighted estimate is small and negative. It should be stressed that these coefficients are very precisely estimated, with a standard error of .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 why their variable matters much less in this equation than in their specification is that it is not mechanically related to the dependent variable, since employment and "enrollment" are now derived from samples

⁷These 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.

with little overlap. This is further proof that Neumark and Wascher's miss-defined variable is causing them to find spurious effects.

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, where we have plotted aggregate teenage employment-population rates for the U.S. 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.⁸ 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

⁸The same series are shown in Card (1992a), Figure 2.

teenage employment rates by 1.3 to 2.6 percentage points starting in 1985.⁹ Examination of Figure 1 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 that 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 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 their conclusion is false. 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.¹⁰ 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.

⁹Neumark 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.

¹⁰These criticisms were echoed in a report by Neumark (1993) circulated by the Employment Policies Institute.

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 population ratio in a state.¹¹ 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 1 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. Most importantly, it automatically accounts for inter-state 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 teenage wages rose significantly faster between 1989 and 1991 in those states with a higher fraction of teens in the affected wage range in 1989. 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).

¹¹ Both outcomes are measured using data for April-December of each year because the minimum wage increase took effect on April 1st.

Column (6) shows the effect of adding the change in the true enrollment rate of teenagers to the employment model. Unlike the mis-specified models reported by Neumark and Wascher, controlling for actual enrollment status 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 support for the view that states that permit firms to pay a subminimum wage to teenagers have higher employment as a result. 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 mis-specified and unreliable for reasons described above. More importantly, their conclusion is implausible given the overwhelming evidence documenting that the vast majority of employers do not 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 denies a substantial body of evidence that consistently finds extremely low usage of the subminimum wage. Freeman, Gray, and Ichniowski (1981) find 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) find that less than 4.8% of Texas fast food restaurants used the youth subminimum wage in 1991. Spriggs, et al. (1992) find 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.¹² Katz and Krueger (1991) find that the introduction of the youth subminimum in 1990 had no discernable effect on teenage workers' wages. And perhaps most definitively, a draft report of a 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.¹³ Furthermore, we conjecture that the use of state minimum wages is less than the use of the federal minimum because the federal subminimum is better known and uniform across states.

Neumark and Wascher (p. 78) claim to show that subminimum wage provisions are used enough to have "a real impact." A closer examination of their evidence suggests just the opposite. Neumark and Wascher's evidence comes from an analysis of spikes in the wage distribution around state subminimum wage levels. They examine data for 12 states that allow subminimum wages. They admit that 9 of the 12 states display no spike at the subminimum. Two of the remaining states have a small spike at the state subminimum, which coincides with the federal minimum wage of \$3.35.

¹² See Bureau of National Affairs, 1993.

¹³ The same study found that only 4.7% of retailers used the subminimum, remarkably close to Katz and Krueger's (1992) estimate. Results from the Department of Labor study were reported in BNA (1993).

The authors admit 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 these same 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 write, "the spike for Minnesota is particularly noteworthy" because it is at a value above the federal minimum. We have reexamined this spike using the same CPS data as Neumark and Wascher. It turns out that only one Minnesota teenager was paid the subminimum wage of \$3.47!¹⁴ Why does Neumark and Wascher's histogram show a spike at \$3.47? The answer is that Neumark and Wascher chose their "bin size" (i.e., the interval of wages to be graphed separately) to 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 perfectly consistent with the previous body of literature that finds 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 75% of the states they examined. They rationalize this finding by noting that average teenage wages are relatively high in these states, so that the market wage exceeds the subminimum. This may be true. But if so, it seems hardly possible

¹⁴ This individual, who was employed in the eating and drinking industry, actually earned \$6.00 per hour accounting for tips.

that the subminimum wage is blunting the effect of the minimum wage in these states.

Conclusion

We have raised three critical data issues in Neumark and Wascher's 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 false (albeit inadvertent) assumption that teenagers either work or attend school. In fact, most teenagers who work also attend school. Their empirical estimates based on the use of this enrollment variable are mis-specified.

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 average teenage wages. Taken literally, their results show that a rise in the coverage-weighted 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. 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 center on 0.

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 growing literature on the low utilization rates 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 by failing to control for school enrollment, and by failing to consider the lagged effect of the law. Contrary to these claims, allowing for a lagged effect and controlling for changes in true enrollment status strengthens rather than reverses the original conclusions in Card's study.

Perhaps Neumark and Wascher are not to be blamed too harshly for their mistakes and faulty analysis. The economics profession places a high premium on empirical results that confirm accepted theories. The negative employment effect of the minimum wage is a lesson taught in almost every introductory economics course and textbook. But there is a lesson here. In situations where the economics profession has a "stake" in the outcome, researchers should strive to be especially careful and even-handed.

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Figure 1

Teen Employment—Population Rates 1975–89

Table 1: Regression Models for State-Level Teenage Employment Rates and Average Wages

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

Table 2: Instrumental Variables Estimates of Alternative Models
for the Teenage Employment-Population Rate

	Choice of Dependent Variable:	
	Neumark-Wascher Estimate of Emp/Pop ^{a/} (1)	Published Annual Emp/Pop ^{b/} (2)
Sample and Weighting Procedure:		
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: Standard errors in parentheses. 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 estimate of state population in year.

^{a/} Dependent variable is estimated teenage employment-population rate for May of the year. The (unweighted) mean and standard deviation of the dependent variable are 0.432 and 0.090.

^{b/} Dependent variable is 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.

Table 3: Estimated Regression Models for State-Average Changes in
Wages and Employment Rates of Teenagers, 1989-1991

	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: Standard errors in parentheses. Estimated on sample of 51 state observations. Regressions are weighted by 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 in columns 1-3 are .090 and .059, respectively. The mean and standard deviation of the dependent variable in columns 4-6 are -0.051 and 0.049, respectively.