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REEXAMINING METHODS OF ESTIMATING MINIMUM-WAGE EFFECTS[†]

Employment and the 1990–1991 Minimum-Wage Hike

By DONALD DEERE, KEVIN M. MURPHY, AND FINIS WELCH*

After nine years of fortuitous neglect, the federal minimum wage was increased more than 25 percent in two steps, from \$3.35 to \$3.80 on April 1, 1990, and then to \$4.25 on April 1, 1991.¹ Our purpose is to investigate the employment effects of these increases.

As evidence of potential effect we examine changes in the distribution of wages. Table 1 refers to employees aged 15–19 earning less than \$5.00 per hour for the years ending March 31, 1989, 1990, and 1991. In each period there is a sharp spike in the wage distribution that coincides with the applicable federal minimum; and there was a substantial shift from below \$4.25 to \$4.25 and higher that coincided with the increased federal minimum. During the year before the first increase, 76 percent of these low-wage employees reported earning less than \$4.25; two years later (i.e., in the year after the second increase), only 25 percent indicated an hourly wage below \$4.25. This shift is much larger than the 9 percent increase in overall average hourly earnings, and we view it as clear evidence that the increased federal minimum raises the cost of hiring relatively unskilled workers.

Table 2 reports employment/population ratios for youth aged 15–19 between 1985 and 1992. The employment rate is indexed to its 1985 value, and the employment index for men 35–44 years old is included for reference. Each year begins in April and goes through March, so that 1990 begins with the increase in the minimum to \$3.80 an hour, and 1991 begins with the increase to \$4.25. Teenage employment rates grew from 1985 through 1989 and then fell in 1990 and again in 1991, with a further, though less pronounced, drop in 1992.

Until recently there had been a consensus that the increase in wage rates documented in Table 1 and the employment changes depicted in Table 2 were essentially cause and effect. There was quibbling about the exact magnitude of the effect, but not much discussion about whether negative employment effects existed. This consensus appears to have been splintered by a series of recent studies (David Card, 1992a, b; Lawrence Katz and Alan Krueger, 1992; Card and Krueger, 1994), although other recent studies continue to find the more standard effect (e.g., David Neumark and William Wascher, 1992). We attempt to provide some glue that can be used to put the pieces back together again.

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¹At the time of the first increase, 12 states and the District of Columbia had minimums in excess of the \$3.35 federal level, but only two of them (Connecticut and California) had a minimum as high as \$4.25.

I. Analysis

The idea that we pursue is the obvious one that minimum-wage increases have the largest effects on employment where effects on wages are also largest, so we compare changes in employment rates of high- and low-wage populations. The high- versus low-wage partitions are demographic (by age, education, race, ethnicity, marital sta-

TABLE 1—WAGES OF HOURLY EMPLOYEES BEFORE AND AFTER THE APRIL 1, 1990 AND 1991 INCREASES IN THE FEDERAL MINIMUM WAGE

Hourly wages	Percentages ^a		
	1989	1990	1991
Less than \$3.35	10.8	9.4	9.7
\$3.35 exactly	16.9	3.3	0.5
\$3.36–\$3.79	23.5	9.6	3.9
\$3.80 exactly	0.8	10.8	0.8
\$3.81–\$4.24	24.1	34.2	10.2
\$4.25 exactly	7.0	10.0	36.3
\$4.26–\$4.99	16.9	22.7	38.6
Total	100.0	100.0	100.0

Source: CPS Outgoing Rotation Earner Study respondents, ages 15–19, paid by the hour with wages below \$5.00.

^aApril 1 of indicated year until March 31 of following year.

TABLE 2—TRENDS IN TEENAGE EMPLOYMENT RATES APRIL 1, 1985 THROUGH MARCH 31, 1992

Year ^a	Employment rate index (1985 = 100)		
	Ages 15–17	Ages 18–19	Men ages 35–44
1985	100.0	100.0	100.0
1986	104.4	99.6	99.8
1987	107.8	102.2	100.2
1988	108.6	104.6	101.0
1989	109.2	104.7	100.9
1990	97.8	99.6	100.1
1991	89.2	95.2	98.3
1992	86.6	94.7	97.7

Note: Employment rate index is the employment/population ratio, indexed to the 1985 value.

^aApril 1 of indicated year until March 31 of following year.

tus, and gender) and geographic (by state of residence). Within each partition we compare employment changes to the fraction of workers who earn low wages (less than or equal to \$4.25 in the year before the 1990 increase). When the population is divided on the basis of age, race, ethnicity, education, and marital status, we find that subgroups with more low-wage workers in 1989 experience larger declines in employment following the increase in the federal minimum. The other two partitions, by state and by gender, give the opposite result. The employment rate of women does not fall relative to the rate for men, and low-wage

employment does not fall more in low-wage states than in higher-wage states. The result for women is not surprising given their persistent employment growth over the past several decades. The result for states might seem surprising, but as we note, employment changes have not been neutral; employment for all workers (not just low-wage workers) grew significantly faster after 1989 in low-wage states than in the country as a whole.

The data are from the 1985 through 1993 CPS Outgoing Rotation Files. The monthly data are arranged into 12-month intervals that begin April 1, and we label each with the calendar year at the beginning of the interval. The arrangement is convenient since it allows for splits on dates when the minimum-wage hikes occur. Hourly wage data are calculated for all earner-study participants as usual weekly earnings divided by usual hours per week.²

Table 3 lists changes in employment rates relative to the 1989 levels. The employment changes appear alongside the incidence of low wages in 1989 for the indicated groups. The incidence of low wages is reported in the first column for men and in the third column for women. The second and fourth columns give the percentage change in employment between the 1989 baseline and 1991. The age comparisons show that employment declines are greatest for those aged 15–19 followed by the declines for those aged 20–24, two of the groups that have the highest incidence of low wages. Comparisons across racial groups show that blacks, the group with the highest low-wage incidence, experienced the largest employment losses; they are followed by whites and then Asians (exactly the order of the fractions of low-wage workers). The relationship between education and employment change is also monotonic and in the expected direction, and the groupings on Spanish ethnicity show the same pattern. The married populations, who have a much

²Workers with imputed values for the earner variables were excluded.

TABLE 4—REGRESSION ESTIMATES OF EMPLOYMENT LOSSES FROM THE 1990–1991 INCREASE IN THE FEDERAL MINIMUM WAGE

Variable	Men	Women	Blacks
<i>Teenagers, Aged 15–19:</i>			
Employment rate, men aged 15–64	3.29 (18.37)	2.27 (8.19)	4.76 (6.41)
Year effects			
Minimum = \$3.80	-4.78 (4.97)	-6.63 (3.73)	-7.47 (2.02)
Minimum = \$4.25	-7.29 (9.04)	-11.37 (4.80)	-10.00 (3.16)
Test: other year effects, Pr > F	0.87	0.32	0.88
<i>High-School Dropouts, Adults Aged 20–54:</i>			
Employment rate, men aged 15–64	1.19 (12.18)	1.66 (7.42)	1.32 (3.50)
Year effects			
Minimum = \$3.80	-1.49 (2.93)	-2.54 (1.80)	-4.43 (2.33)
Minimum = \$4.25	-3.13 (7.14)	-5.17 (2.72)	-6.66 (4.10)
Test: other year effects, Pr > F	0.19	0.924	0.39

Notes: Observations are aggregates by state and year (1985–1992). Years begin April 1. The dependent variable is the natural log of the employment/population ratio for the group indicated. The aggregate employment variable refers to men only and is also a natural logarithm. The minimum-wage variables are indicators for 1990 (when \$3.80 applied) and 1991 and 1992 (when \$4.25 applied). This specification has one indicator that identifies the 1990 observations and another that identifies the 1991 and 1992 observations without distinguishing between them. The coefficients on the minimum-wage indicators have been multiplied by 100. The rows labeled “Test: other year effects, Pr > F” refer to the alternative hypothesis that each of the eight years has an independent effect. The regressions that are restricted to women include a trend term; the regressions for blacks include pooled observations for men and women with an indicator that distinguishes between them. All regressions also include state effects. Numbers in parentheses are *t* statistics.

first column refers to men of all races, the second column to women of all races, and the third column to blacks, both men and women. The regressions for women include a time trend, and the regressions for blacks include an indicator for men. The unit of observation is a state-by-year by gender aggregate (the observations for blacks are pooled across gender) for 1985–1992. The coefficients on the aggregate employment

rate are elasticities, while the coefficients on the minimum-wage indicators have been multiplied by 100 to signify percentage changes.

The estimates for teenagers imply that teenage employment is quite sensitive to the aggregate employment of men, with elasticities of 3.3, 2.3, and 4.8 for men, women, and blacks, respectively. The minimum-wage variables show that teenage employment dropped sharply following the 1990 increase in the federal minimum and dropped again after the second increase in 1991. Compared to the employment level projected from the movement in aggregate employment with the \$3.35 federal minimum, teenage employment was 4.8-percent, 6.6-percent, and 7.5-percent lower in 1990 for men, women, and blacks, respectively, and 7.3-percent, 11.4-percent, and 10.0-percent lower in 1991–1992.

The estimates for adult high-school dropouts tell a similar story. Elasticities of employment with respect to aggregate employment are 1.2, 1.7, and 1.3 for men, women, and blacks, respectively. The minimum-wage variables show a decline in the employment of each group following the increase to \$3.80 and a further decline after the increase to \$4.25. Compared to the employment level projected from the movement in aggregate employment with the \$3.35 federal minimum, employment of adult high-school dropouts was 1.5-percent, 2.5-percent, and 4.4-percent lower in 1990 for men, women, and blacks, respectively, and 3.1-percent, 5.2-percent, and 6.7-percent lower in 1991–1992.

Table 2 showed a distinct time pattern to teenage employment during 1985–1992 with sizable increases from 1985 through 1989 followed by the steep declines from 1990 through 1992. A similar pattern holds for the employment of adult high-school dropouts. The minimum-wage variable for \$3.80 is an indicator for 1990, and the \$4.25 variable is an indicator for 1991 and 1992 jointly. We tested the alternative hypothesis that eight separate year effects are necessary to describe the time pattern of employment in each regression. The reported *p* values are for the test of this hypothesis

against the specification with only the aggregate employment and minimum-wage variables (and a time trend in the regressions for women). In every case, the controls for aggregate employment and time trend coupled with the minimum-wage effects are sufficient to describe the employment changes of teenagers. Evidently, the increases in employment prior to 1990 are no more than would be expected given the movement in aggregate employment, while the declines after 1989 are captured well by the minimum-wage variables.

While Table 4 shows that the minimum-wage effects for teenagers are large, due to their disproportionate representation among low-wage workers, it also shows significant negative employment effects of the minimum wage for adults with little education. Teenagers comprise a significant part of the low-wage population, but they are not a majority. Only 32 percent of those with low wages just prior to the 1990 increase in the federal minimum were ages 15–19, while 20 percent were of Spanish ethnicity, 16 percent were black, and 12 percent were women over the age of 19 with less than 12 years of schooling. Teenagers bear a significant part of the burden from minimum wages, but most will outgrow it. The remaining two-thirds of the low-wage population, which is disproportionately minority, female, and poorly educated, is less likely to be so lucky.

II. Summary

On March 31, 1990, the federal minimum wage was \$3.35 per hour; it was increased to \$3.80 the next day and to \$4.25 one year later. In the 12 months following the second increase, the employment/population ratio for teenage men fell 15.4-percent below the level for the 12 months prior to the first increase. For teenage women, the drop was 12.9 percent. Employment in the 20–24 age range also fell relative to older workers, who typically earn higher wages. In addition to the partitions based on age, we also divided the population on the basis of race, Spanish ethnicity, education, and marital status. In each of these partitions, we find that the group with the highest percentage

of low-wage workers is also the group whose employment shows the greatest drop. However, when we divide the population on the basis of gender, and when we distinguish between high- and low-wage states, the low/high-wage contrasts give seemingly anomalous results. Employment of women does not fall relative to employment of men, and we do not find sharper employment losses among low-wage workers in states with disproportionately large numbers of low-wage workers. We do not view our gender and state findings as refutation of the *law of demand*; instead we take them as a warning that minimum wages are not everything that affects employment and that other things must be considered before we can correctly assess the employment effects of minimum wages.

For the gender and geographic splits, we find that the minimum-wage responses are swamped by the broader trends of increasing labor-market participation of women and of employment expansion in the South and Southwest where wages are lower than in the Northeast, Upper Midwest, and West. It is true, however, that when men and women are viewed separately the minimum-wage increases coincide with shifts toward less employment for lower-wage workers. Similarly, employment of low-wage workers falls relative to those who typically earn more both in high-wage states and in low-wage states.

Our naive comparisons show relative employment reductions of low-wage workers in some cases but not in others. In the exceptions we find simple explanations of results that might otherwise appear to be surprising. It follows that the cases in which employment responses are not surprising ought also to be considered for alternative causes. The most likely candidate is the recession that began in 1990. Between the year preceding the first increase in the federal minimum wage and the year following the second, employment of men aged 25–64 fell 2.5 percent, and employment of women in the same age range fell 0.3 percent.

In regressions that control for changes at the state level in the aggregate employment of men, we consider the associated changes

in employment of six groups with disproportionately large numbers of low-wage workers. Three of the groups are teenagers, aged 15–19: men, women, and blacks (both men and women). The other three are high-school dropouts aged 20–54, also grouped as men, women, and blacks (both men and women). In the five years preceding the first minimum-wage hike, employment of low-wage workers grew relative to employment of others, but the regression control for aggregate employment and trend suggests that these increases are no larger than expected. This is not true for the period after the minimum-wage increases. Although there are reductions of employment rates in prime age ranges, the reductions among low-wage employment are greater than predicted. During the year when the \$3.80 hourly minimum existed, we estimate that, relative to projections of employment rates based on the \$3.35 minimum, employment of teenage men was reduced by 4.8 percent; the corresponding reductions for teenage women and teenage blacks are 6.6 percent and 7.5 percent, respectively, while for adults (ages 20–54) who did not finish high school they are 1.5 percent, 2.5 percent, and 4.4 percent, respectively, for men, women, and blacks. Then, when the minimum wage was raised a second time to \$4.25 per hour, employment of low-wage workers also fell a second time. The reductions over the projections based on the \$3.35 minimum are: 7.3 percent, 11.4 percent, and 10.0 percent for teenagers (men, women, and blacks, re-

spectively), and for high-school dropout adults they are 3.1 percent, 5.2 percent, and 6.7 percent.

The regression estimates have no surprises. When the cost of employing low-wage laborers is increased, fewer low-wage laborers are employed.

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