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Abstract

In this paper we use an estimating equation from the research of leading proponents of the view that minimum wage increases do not cause employment losses. Rather than using annual data from the May *Current Population Survey* (CPS), we test this hypothesis using monthly data from both the Survey of Income and Program Participation (SIPP) and the CPS. We find the traditional result that neoclassical theory would predict: minimum wage increases create employment losses that are concentrated among less valued workers. Minimum wage increases have an insignificant effect on the employment of prime age workers (aged 25 to 61), but they have large and significant negative employment effects on teenagers, young high school dropouts, and young blacks. Hence, the very people minimum wage policies claim to help are most likely to be adversely affected.

Introduction

Neoclassical competitive models of firm behavior predict that as the price of labor rises, firms will employ fewer laborers and that, holding wage rates constant, the least valued workers will be the first to lose their jobs or the last to be hired.[1] Legislated minimum wage increases are an exogenous shock to the price of labor, and data from periods when the minimum is raised can be used to empirically test whether employment is reduced and whether those reductions are concentrated among less valued workers.

We use monthly data from the 1990 research panel of the Survey of Income and Program Participation (SIPP) and the Current Population Survey (CPS) to examine these employment effects. We find that employment declines in response to increases in the minimum wage much more than recent research has suggested and that the employment decreases are concentrated among less valued workers.

Our research comes at a time when the empirical evidence regarding the negative employment effects of raising the minimum wage has been called into question. A controversial body of research now suggests that raising the minimum wage has, at worst, no impact on employment and may even increase employment (Card 1992a, 1992b; Katz and Krueger 1992; Card, Katz, and Krueger 1994; Card and Krueger 1994; Card and Krueger 1995). From a theoretical perspective, these papers have been characterized as an assault on the law of demand (Ehrenberg 1995).

If in fact "modest" increases in the minimum wage have no effect on employment then the appropriateness of such minimum wage increases as a mechanism to assist the working poor is strictly a distributional issue.[2] However, if job losses are associated with raising the minimum wage, and if those losses are concentrated among the vulnerable groups the policy claims to assist, then one must take this "unintended consequence" into consideration in any examination of

the policy's efficacy. For this reason, estimation of the elasticity of employment with respect to minimum wage increases is more than simply an empirical test of economic theory.

Our examination of the employment effects of raising the minimum wage touches on both these theoretical and policy considerations. In the next section, we briefly review the new literature on the minimum wage. We then describe the estimations conducted and the data used. Finally, we discuss our results in the context of the minimum wage policy debate.

The New Economics of the Minimum Wage

The new literature examining employment impacts of the minimum wage contains a number of studies which report either no decrease in employment from raising the minimum wage or employment increases (Card 1992a, 1992b; Katz and Krueger 1992; Card, Katz, and Krueger 1994; Card and Krueger 1994; Card and Krueger 1995). Most of these studies have now generated specific replies that claim that raising the minimum wage decreases employment (Neumark and Wascher 1992; Neumark and Wascher 1994; Deere, Murphy, and Welch 1995; Taylor and Kim 1995; Neumark and Wascher 1995a, 1995b). Because the new studies of the minimum wage vary widely in the techniques used, we focus our discussion on those that used *Current Population Survey* (CPS) data and employed an estimation strategy comparable to the one we use in this paper (Neumark and Wascher 1992; Neumark and Wascher 1994; Card et al. 1994; Neumark and Wascher 1995a; Card and Krueger 1995; Deere, Murphy, and Welch 1995).[3]

We focus on the set of studies that employed a pooled, time-series, cross-sectional approach to estimation using CPS data. This approach takes advantage of the fact that some states set minimum wages higher than the federal minimum. As originally pointed out by Neumark and Wascher (1992), using state-level observations over time allows variation across

states in the minimum wage level that can be used to identify employment changes. In these studies, the typical reduced-form equation is:

$$E_{it} = \alpha_0 + \beta MW_{it} + \gamma X_{it} + \delta T_t + \theta S_i + \varepsilon_{it} \quad . \qquad \textbf{(1)}$$

E_{it} is the employment to population ratio of the group of interest in state i in year t; MW_{it} is a variable representing the minimum wage in state i in year t; X_{it} is a set of explanatory variables; T_t is a set of time dummies; and S_i is a set of locational (state) dummies. The particular equation shown here is drawn from Neumark and Wascher (1992) and Card and Krueger (1995).

These studies have often reported either no effect on employment from raising the minimum wage or small negative elasticities relative to consensus estimates reported by historical surveys such as Brown, Gilroy, and Kohen (1982). For example, Neumark and Wascher (1992) used observations from the May CPS for the years 1973 through 1989 to estimate equation (1). They estimated the equation for teenagers (aged 16 to 19) as well as a group they refer to as young adults (aged 16 to 24). For teenagers, they report elasticities ranging from -0.1 to -0.2 and for young adults from -0.15 to -0.2. While the sign of the elasticities is consistent with the view that minimum wage increases cause employment decreases, they do not find consistent evidence that the effects are larger among younger, and presumably less-skilled, workers. They note this theoretical inconsistency in their results and discuss it at some length in later work (Neumark and Wascher 1995b).

In a response to Neumark and Wascher (1992), Card et al. (1994) offer a new analysis of their data. Among other criticisms, Card et al. (1994) show that the estimation results are sensitive to the use of two variables. First, when an explanatory variable measuring the fraction of teenagers in school and not working is dropped, the Kaitz index parameter is no longer statistically significant.[4] Second, when the level of the minimum wage in each state is used instead

of the Kaitz index to measure the effect of the minimum wage on employment and the variable measuring the fraction of teenagers in school and not working is also dropped, their estimates indicate that the effect of raising the minimum wage on employment is positive and statistically significant at the .05 level.[5] These results raised doubts about the robustness of the Neumark and Wascher (1992) results.

Neumark and Wascher (1994) respond to these criticisms. They argue that the inclusion of an enrollment rate is theoretically correct. As an alternative, they construct a new enrollment rate variable of the type suggested by Card et al. (1994) and find that the estimated effect of raising the minimum wage on the employment rate of both teenagers and young adults is not significantly different from zero at conventional levels. In response to the criticism regarding the Kaitz index, they argue that it is preferable to the level of the state minimum wage in such estimations from a theoretical perspective, but they acknowledge the results found by Card et al. (1994). Additional detailed accounts of this exchange are now available from each of the authors (Neumark and Wascher 1995a; Card and Krueger 1995).

Another study which makes use of the CPS data and a similar estimation strategy is that of Deere, Murphy, and Welch (1995). A major difference between the Deere et al. (1995) study and those discussed above is that they use monthly CPS observations rather than data only from the month of May. They construct intervals of monthly data from 1985 through 1993 that begin on April 1 of each year and end on the last day of March the following year. Using annual averages across these groupings of months, they estimate an equation similar to equation (1).

There are some other important differences in the Deere et al. (1995) approach. They do not use the level of the state minimum wage to capture the effect of the minimum wage on the employment to population ratio. Instead, they include dummy variables reflecting increases in the

federal minimum wage rate. Consistent with the other studies, they include state level dummy variables but exclude year dummies based on an F-test. The explanatory variables they include in their estimations are a subset of those used by Card et al. (1994).

The 1990 increase in the federal minimum wage was from $3.35 to $3.80, an increase of 13.4 percent. Deere et al. (1995) report declines in employment of -4.8, -6.6, and -7.5 percent for male, female, and black teenagers (aged 16 to 19), and -1.5, -2.5, and -4.4 for male, female, and black high school dropouts (aged 20 to 54) as a result of the 1990 increase. Although they do not calculate elasticities in their work, the implied elasticities given the 13.4 percent minimum wage increase are -0.36, -0.49, and -0.56 among male, female, and black teenagers and -0.11, -0.19, and -0.33 among male, female, and black high school dropouts.[6]

Because the Deere et al. (1995) results are based on more information than one month from each CPS year, they are superior to those discussed above from an informational standpoint. However, their use of a set of dummy variables to capture the effect of raising the minimum wage makes direct comparison to those other studies difficult. Nonetheless, Deere et al. (1995) do provide evidence that minimum wage increases reduce employment among teenagers and high school dropouts and that the employment of blacks in both groups appears more sensitive than that of nonblack males or females.

Methods

The only fundamental difference in our estimation strategy relative to the studies discussed above is that we use monthly information rather than information in May from each CPS year, as in Neumark and Wascher (1992, 1994) and Card et al. (1994), or information from annual averages of months, as in Deere et al. (1995). We follow the approach of Neumark and Wascher

(1992) in using the variation across states in minimum wage rates to capture the effect of higher minimum wages on employment.

We provide three sets of estimates. The first uses monthly observations from the 1990 Survey of Income and Program Participation (SIPP). For each of four months beginning in February 1990, the SIPP interviewed a new rotation group that in itself was a random sample of the United States populations. These four rotation groups were interviewed eight times at four-month intervals. Each interview contains monthly information for the preceding four months. We ordered the rotation groups chronologically to create a 29-month interval during which all four rotation groups had interview responses. This time period spans January 1990 to May 1992 and encompasses both the April 1990 increase in the federal minimum wage from $3.35 to $3.80 per hour and the April 1991 increase from $3.80 to $4.25 per hour.

It is possible through weighting to use the SIPP data in a number of different configurations while still maintaining a nationally representative sample. We chose to use information only on those individuals who responded to each of the eight surveys (over the 29 month period) and to weight accordingly. In this approach, information on approximately 25,500 working age individuals is available to calculate the monthly, state-level observations used in our analysis. The number varies slightly over time because each month we use information on a cross section of people aged 16 to 61 from these data.

Because the SIPP data have not been used in this context before, we construct a similar data set from the monthly outgoing rotation groups of the CPS which also spans the period January 1990 to May 1992. We use these CPS monthly data in estimations identical to those performed using the SIPP data to establish the robustness of those results. Again, weights are used which make the sample nationally representative. In each month, approximately 22,500

observations of working age individuals are available for use in construction of the state-month observations. Our final set of estimates also uses monthly CPS data, but for the years 1979 through 1993. We report these estimates to show that our results are not unique to the 1990 through 1992 period.

The major advantage of using data for all months rather than one annual observation from the month of May is that the amount of information is increased in any year by a factor of 11. The number of state-month observations potentially available between January 1990 and May 1992 is 1,479 versus the sample of 751 state-month observations employed by Neumark and Wascher (1992, 1994) or Card et al. (1994) using May data only from 1973 to 1989.[7] Over the longer CPS panel we examine, our sample size rises to 8,568 state-month observations.

The equation we estimate is taken from what we believe to be the preferred equation of Card et al. (1994) in their interchange with Neumark and Wascher (1992, 1994).[8] This equation is identical to equation (1) except that the subscripts are redefined to represent months instead of years.

$$E_{im} = \alpha_0 + \beta MW_{im} + \gamma X_{im} + \delta M_m + \theta S_i + \varepsilon_{it} . \qquad \textbf{(2)}$$

Each of the variables is defined as in equation (1). The minimum wage variable we employ is the one advocated by Card et al. (1994) and Card and Krueger (1995), the natural log of the greater of the state or federal minimum wage.[9] The X_{it} are a set of control variables that include the prime age male unemployment rate in the state and the proportion of the state's population in the relevant group of interest as measured in each month of the data. Another regressor included is the average adult wage rate in that month for each state. These variables are defined exactly as in the estimations performed in Card et al. (1994) and Card and Krueger (1995, Table 7.1). M_m are a set of month dummies, S_i are state effects, and ε_{im} is a stochastic error term.

Heteroskedasticity tests on all of the equations estimated were conducted. Evidence was found of the presence of heteroskedasticity in all equations. Thus, all of the standard errors presented in the paper are corrected using White's general method. The means and standard deviations of all variables used in the analyses are reported in Appendix Tables 1A, 2A, and 3A.

SIPP Estimates

Table 1 contains the initial estimates of equation (2) from the SIPP data. Column (1) shows the estimated equation for prime age adults (aged 25 to 61). As expected, since few prime age adults work at wages where they might be affected by an increase in the minimum wage, the parameter associated with the log minimum wage variable is not significantly different from zero at the 5 percent level.

In columns (2) and (3) of Table 1, we provide estimates for the two groups most commonly considered to be impacted by minimum wage increases—teenagers (aged 16 to 19) and young adults (aged 16 to 24). For both groups, the minimum wage parameters are negative and significantly different from zero at the .01 level. Because on average teenagers have less job experience, one would expect the elasticity of employment with respect to the minimum wage to be larger among teenagers than among the combined group of teenagers and older youths. Here, we find the expected result, with an estimated elasticity of -0.87 for teenagers and -0.36 for young adults.

Among the group of young adults, one would also expect to observe stronger employment effects from raising the minimum wage among less skilled groups or among groups that are more likely to be discriminated against in a market in which wages are not permitted to fall to overcome discrimination. To test these hypotheses we stratify the data in column (3) by race in columns (4)

and (5), and then stratify young adults aged 20 to 24 by those with and without a high school diploma in columns (6) and (7).[10]

Again, we find effects that are consistent with theory. The estimated minimum wage parameters for both black and nonblack young adults is negative and significantly different from zero at the 0.01 level. The estimated elasticity among blacks is -0.51; among nonblacks, it is -0.32.[11]

The minimum wage parameter is also negative and significantly different from zero at the .01 level for those without a high school diploma. In contrast, there is no statistically discernible relationship between the minimum wage rate and employment of high school graduates in this age group. While the effective elasticity for high school graduates is zero, the estimated elasticity for those who have not received a high school degree is -0.89. Again, the relatively less valued group is more adversely impacted by raising the minimum wage.

Card and Kreuger (1995), among others, have demonstrated the sensitivity of estimates of the employment effect of minimum wage increases in response to what appear to be minor changes in model specification. To establish the robustness of our estimates, we conducted a range of sensitivity tests for each of the equations in Table 1. We found that for all of our estimates the results were insensitive to the types of changes in specification that have been observed elsewhere. In Table 2, we provide an example of these robustness checks using our SIPP sample of teenagers.[12]

Column (1) through Column (4) of Table 2 contain estimates of equation (2) where the relevant state minimum and the price of alternative labor (the average adult wage rate) are each entered in logarithmic form, as was done in the work of Card et al. (1994). Column (5) through Column (8) include these regressors at their levels. Across the columns, we drop individually and

in combination the explanatory variables for the proportion of teenagers in the state population and the prime age male unemployment rate. Across all eight specifications considered in Table 2, the minimum wage parameter is negative and significantly different from zero at the 0.01 level. In the linear-log specifications in Column (1) through Column (4), the estimated elasticities range from -0.84 to -0.95. In the levels specification, the elasticities range from -0.88 to -1.01.

Robustness Checks Using Monthly CPS Data from January 1990 to May of 1992

The estimated elasticities we obtain from the monthly SIPP data exceed those obtained in the studies discussed above. Because no other study of the minimum wage has used SIPP data, it is possible that our estimated elasticities are generated solely by some peculiarity in that sample. We address this issue by comparing our results with those from the CPS monthly data for the same period. For many of the subgroups considered in the SIPP data, we were unable to calculate similar variables in the CPS because of sample size (variability) issues.[13] We were able to construct parallel data sets in the CPS for prime age adults (aged 25 to 61), teenagers (aged 16 to 19), and young adults (aged 16 to 24).

Table 3 contains reestimates of equation (2) for these three groups. As can be seen in column (1), as was the case using SIPP data, there is no significant relationship between the minimum wage rate and the employment to population ratio of prime age adults. However, the estimated minimum wage parameter is negative and significantly different from zero at the 0.01 level for teenagers (column 2) and young adults (column 3). Also, the theoretically implied ordering of the elasticities is observed here as it was for the SIPP-based estimates. The estimated elasticity for prime age adults is -0.01, -0.19 for young adults, and -0.49 for teenagers.

The CPS-based elasticities are about one-half the magnitude of those found using the SIPP data. Some of the difference in these estimates is related to basic differences in the sampling schemes of the two data sets. Two principal differences are worth highlighting. First, the CPS is a cross-sectional data base with different people interviewed in each month, while the SIPP is a panel in which the same people are present in every month of data. Because the SIPP reinterviews the same people each month, it will naturally have much less sampling variability from one month to the next than the CPS. This is particularly true in our application as we only included observations on individuals present on every month of the data.[14]

Second, the CPS asks employment questions about the preceding week while the SIPP asks such questions about the preceding month. Since the calendar period over which the SIPP asks a person to consider reporting themselves as working is longer, we believe the response is less subject to variability due to short-term phenomena such as missing a week of work.

While we can not directly address the proportion of the difference in the SIPP and CPS estimates due to these first two sources, there is one dimension in which we can offer some evidence. In the CPS all of the states are individually identified. In the SIPP, a number of the smaller states are grouped together. In the estimates based on the SIPP, we excluded states that could not be individually identified.[15] If those states were systematically different from the others, this could bias the estimates.

To investigate this potential bias, we reestimated the equations reported in the first three columns in Table 3 but did not include the set of states excluded in our SIPP estimates. As can be seen in Column (4) through Column (6), the minimum wage parameter for prime age adults remained insignificant, and the minimum wage parameters for teenagers and young adults continue to be significant, but the elasticities increased to -0.57 and -0.23 respectively. This

evidence from the CPS suggests that dropping the states which are grouped together in the SIPP is likely to lead to larger negative elasticities. This bias may partially explain why the estimated elasticities we obtained from the SIPP are higher than from the CPS.

In Table 4 we perform the same set of robustness checks on our teenager equation as we conducted for the SIPP teenagers in Table 2.[16] Columns (1) through (4) contain linear-log models with various parameter exclusions imposed. Columns (5) through (8) contain a specification in levels, again dropping various combinations of regressors. Across all eight specifications, the minimum wage parameter is negative and significantly different from zero at the 0.01 level. In the linear-log specification, the estimated elasticities vary from -0.49 to -0.54. In the levels specification, the estimated elasticities vary from -0.49 to -0.55.

Our robustness checks show that the SIPP data systematically generate higher estimated elasticities than the CPS data. We believe the reduced sampling variability in the SIPP panel data is one explanation for why our estimates are higher than those found in studies using cross-sectional CPS data. In addition, the SIPP estimates are probably somewhat higher since we had to omit some states from that analysis. However, even when we use the CPS over the same time period and include all states, we still find that higher minimum wages significantly reduce employment and less valued groups are more adversely affected.

Robustness Checks Using Monthly CPS Data from 1979 to 1992

Our estimated elasticities for teenagers using either the SIPP or CPS monthly data are well above recent estimates and also exceed the consensus range of estimates reported by Brown et al. (1992). To see if these results are period-specific, we expand the time frame under consideration to include all years with available monthly CPS observations prior to 1990. This changes our

sample to cover the years from 1979 to 1992. While wage information is available for May back to 1973, the same information that was collected in May only became available on a monthly basis for each outgoing rotation group in 1979. This explains the use of the May observation from 1973 through 1989 in the work of Neumark and Wascher (1992) and our use of the data beginning in 1979 here. As previously noted, although we are unable to duplicate all the years they examine, by using all months since 1979 we actually have many more observations in our analysis.

Table 5 contains estimates of equation (2) for prime age adults, teenagers, and young adults using monthly CPS data from January of 1979 through December of 1992. For prime age adults we find that the minimum wage parameter is positive and statistically significant at the .01 level. This result is theoretically consistent with employers substituting toward higher skilled labor as its relative price falls. For teenagers and young adults, however, higher minimums are once again associated with reduced employment. The minimum wage parameter is negative and significantly different from zero at the 0.01 level for both teenagers and young adults. Across the groups we again observe an ordering of employment effects that is consistent with theory. The estimated elasticity is -0.37 for teenagers and -0.19 for young adults. When we use this longer panel, our estimated elasticity for teenagers is closer to but still somewhat above the consensus range of estimates reported by Brown et al. (1982).

In Table 6 we perform the same set of robustness checks on our teenager equation as was conducted in Table 4.[17] Column (1) through Column (4) of Table 6 contain estimates for the linear-log specification, and Columns (5) through (8) contain estimates from a level specification. Across all eight columns, the minimum wage parameter is negative and significantly different from

zero at the 0.01 level. In the linear-log specifications, the estimated elasticities range from -0.37 to -0.41. In the level specifications, the estimated elasticities range from -0.32 to -0.36.

Although our monthly data do not span the exact range of years used in the analysis of Neumark and Wascher (1992, 1994), we do have the capacity to perform estimates similar to theirs and those of Card et al. (1994) and Card and Krueger (1995) by selecting only yearly observations from the month of May in our data and reestimating equation (1).

In Column (9) of Table 6, we first report the estimates Card et al. (1994) obtained using the same set of regressors and model specification we have used throughout our analysis, but employing annual data from just the month of May for the period from 1973 through 1989. As can be seen, they report a minimum wage parameter of 0.17 with a standard error of 0.08. In Column (10) we create a similar estimate using data from the month of May for the years covered by our sample, 1979 through 1992. Our estimated minimum wage parameter is also positive, 0.07, but the relatively larger standard error of 0.13 indicates the parameter is not significantly different from zero at conventional levels. In short, if we had constrained ourselves to using only the month of May in our data, we, too, would have concluded that minimum wage increases had no effect on employment over the period 1979 through 1992.

Conclusions

The estimating equation used to obtain the elasticity estimates reported in this paper was drawn directly from the research of the leading proponents of the view that minimum wage increases do not result in employment losses. When we only use data from the CPS for the month of May, from 1979 to 1992, we obtain a similar result—higher minimum wages have no significant effect on the employment of teenagers. However, when we use all available months of

data from the CPS over this same period, we obtain a result consistent with standard theory: minimum wage increases reduce the employment of teenagers and other vulnerable groups in the labor force.

The use of data from the CPS only for the month of May is an artifact of the historical evolution of the design of the CPS. There is no compelling case for restricting analysis to yearly variations in the month of May. Moreover, if one had the choice of a month to use to gauge the employment behavior of teenagers across years, May is a month one would want to avoid because most teenagers are still in school. A summer month when school was not in session for most teenagers would better capture their unconstrained behavior.

Using an equation identical to that employed by Card et al. (1994), and employing monthly CPS data for the period from January of 1979 to December of 1992, we obtain estimated elasticities of employment with respect to the minimum wage that range from -0.32 to -0.41 for teenagers. Our estimated elasticity for young adults is -0.19. The larger elasticity among teenagers is consistent with the predictions of neoclassical theory. Our elasticity range for teenagers is, however, somewhat higher than the historical consensus reported in the Brown et al. (1982) survey. Hence our estimates also contradict the prevailing view that the addition of information from later periods lowers the estimated elasticity of employment with respect to the minimum wage.

The prevailing opinion that the employment effect of raising the minimum wage has diminished over time is also contradicted by the estimates obtained using monthly CPS data for the period from January of 1990 to May of 1992. The calculated elasticities of employment with respect to the minimum wage for teenagers based on that sample range from -0.49 to -0.54. The estimated elasticity for young adults is -0.19. The estimated elasticity for teenagers in this recent

period are larger than in the longer time frame also considered in the paper. The greater elasticity among teenagers than among young adults across this recent period is also consistent with the predictions of neoclassical labor theory.

The same estimating equation was employed using monthly observations from the SIPP for the period from January 1990 to May of 1992. For those estimates, the calculated employment elasticities for teenagers range from -0.84 to -1.01. The estimated elasticity for young adults is -0.36. Again, the larger elasticities among teenagers are consistent with theory. While a preference for the estimates from the SIPP relative to the CPS is a matter of judgment, the SIPP results suggest that traditional estimates from cross-sectional data may understate the employment impacts of raising the minimum wage.

Using the SIPP data, we also examined the employment elasticities for relatively skilled and unskilled groups of workers. The results are consistent with underlying theory. Raising the minimum wage has no discernible impact on those aged 20 to 24 with a high school degree but has a negative impact on the employment of those aged 20 to 24 who have not received a high school degree. Similarly, the estimated elasticity of employment among black young adults (aged 16 to 24) is higher than among nonblack young adults. This result is consistent with a lower demand for black young adults at the minimum wage because of either lower skills or discrimination.

While we view the evidence amassed and the robustness checks performed as affirming the neoclassical prediction that minimum wage increases are associated with employment losses, there is a broader policy context within which these results play an important role. In other research using simulations that assumed that raising the minimum wage had no employment impacts, we demonstrated that minimum wage increases are not a target-effective way of helping the working

poor by showing that only 15 cents of every dollar of the increased wage bill associated with raising the minimum wage from $3.35 to $4.24 actually flowed to poor families (Burkhauser, Couch, and Glenn 1996). We have shown here that ignoring behavioral effects is likely to lead to an overstatement of the efficacy of minimum wage increases in helping the working poor because the low-skilled and disadvantaged groups that minimum wage policies claim to help are most likely to be adversely affected by them.

Endnotes

1. The neoclassical arguments against minimum wage increases on efficiency and income distributional grounds were first fully laid out by Stigler (1946).

2. A literature exists on the distributional affects of minimum wage increases. See Horrigan and Mincy (1992), Burkhauser and Finegan (1989), Burkhauser, Couch, and Glenn (1996), and Burkhauser, Couch, and Wittenburg (1996).

3. A fuller discussion of the recent literature on the minimum wage, as well as the work which preceded it, can be found in Burkhauser, Couch, and Glenn (1996), Card and Krueger (1995), Neumark and Wascher (1995a), Brown, Gilroy, and Kohen (1982), and Brown (1988).

4. The Kaitz index has been used in many studies of the impact of the minimum wage on employment. It is defined as the coverage adjusted ratio of minimum to average adult wages. It is included as the minimum wage variable in equation (1) in Neumark and Wascher (1992).

5. These results are also presented in Card and Krueger (1995, Table 7.1, Column (3)).

6. These elasticities were generated under the assumption of no aggregate changes in the employment rate of men aged 15 to 64.

7. The 751 observations used by Neumark and Wascher (1992) were derived on 50 states plus the District of Columbia multiplied by the 13 years for which complete data were available in the CPS (1977-89) plus an additional four years of data for the 22 larger states identified in the CPS from 1973 to 1976. We have information on 50 states plus Washington, DC, across 29 months, which gives us 1,479 total observations (51 x 29). In the SIPP, we have information on 41 states plus Washington, DC, across 29 months, which gives us 1,218 total observations (42 x 29). These missing states are Vermont, Maine, Iowa, North Dakota, South Dakota, Alaska, Idaho, Montana, and Wyoming.

8. This equation is also emphasized in Card and Krueger (1995).

9. Information on state minimum wages is taken from Neumark and Wascher (1992) and *The Book of States* (1992-93).

10. For the samples of young adult high school graduates and nongraduates, we truncate our sample to aged 20 to 24. We do this because we do not want to include persons in the nongraduate category who fall into this classification solely on the basis of their age. Presumably, if we include all persons aged 16 to 24 in our analysis of these two groups, the majority of individuals aged 16 to 19 would not have completed their high school degree because they are still in school.

11. In addition to the nine states that could not be individually identified in the SIPP, the following nine states were dropped for the analysis of young blacks because of sample

size: Hawaii, Nebraska, New Hampshire, Rhode Island, Arizona, Oregon, Kentucky, New Mexico, and Utah.

12. In an appendix available upon request we repeat each equation in Table 1 using all of the specification examples in Table 2. These specifications are based on those presented by Card and Kreuger (1995, Table 7.1).

13. In our estimations using both the CPS and SIPP data, we only use groups that we can identify across all periods in our estimations. Due to the panel nature of the SIPP, less sample variability exists in identifying some of these groups across smaller states than exists in repeated cross sections like the CPS. As a result of sampling variability in the CPS, we are unable to generate a balanced panel of state observations without dropping a large number of states in the black and high school dropout equations.

14. The SIPP weights allow one to make this choice and still obtain nationally representative estimates.

15. These states are Vermont, Maine, Iowa, North Dakota, South Dakota, Alaska, Idaho, Montana, and Wyoming. It should be noted that in the work of Neumark and Wascher (1992) and Katz, Card, and Krueger (1994), only 22 states are used prior to 1976, so a similar issue arises in their work.

16. A full set of these robustness checks is available on request.

17. Similar sets of robustness checks for each of the equations are available from the authors upon request.

Table 1. Effects of Minimum Wage on the Employment to Population Ratio of Various Socio-Economic Groups (1990 Survey of Income and Program Participation, January 1990 to May 1992)

			Young Adults and Teenagers Aged 16 to 24			Young Adults Aged 20 to 24	
Explanatory Variables	**Prime Age Adults Aged 25 to 61 (1)**	**Teenagers Aged 16 to 19 (2)**	**All (3)**	**Black (4)**	**Non-Black (5)**	**High School Graduate (6)**	**Non-High School Graduate (7)**
Log Minimum Wage	-0.005	-0.38**	-0.21**	-0.20**	-0.19**	-0.03	-0.43**
	(0.009)	(0.05)	(0.03)	(0.08)	(0.03)	(0.04)	(0.10)
Log of Average Adult Wage		-0.06	-0.06	0.05	-0.06*	-0.14**	0.71**
		(0.05)	(0.04)	(0.10)	(0.04)	(0.04)	(0.13)
Log of Average Teenage Wage	-0.01*						
	(0.005)						
Proportion of Age Groups in the Working Age Population	0.09	2.04**	0.60**	0.44	0.46	0.88**	12.7**
	(0.07)	(0.43)	(0.20)	(0.94)	(0.24)	(0.21)	(1.64)
Prime Age Male Unemployment Rate	-0.53**	0.23	0.10	-1.40**	0.35**	-0.08	0.02
	(0.05)	(0.17)	(0.10)	(0.29)	(0.10)	(0.14)	(0.35)
State and Month Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.90	0.60	0.77	0.57	0.73	0.66	0.42
Elasticity	-0.007	-0.87	-0.36	-0.51	-0.32	-0.04	-0.89
N	1,218	1,218	1,218	957	1,218	1,189	986

**Significant at the 5 percent level.

Note: The standard errors shown in the parentheses are calculated using the White method to correct for heteroskedasticity (White 1978).

Source: 1990 Survey of Income and Program Participation, January 1990 to May 1992.

Table 2. Effects of Minimum Wage on the Teenage (Aged 16 to 19) Employment to Teenager Population Ratio (1990 Survey of Income and Program Participation, January 1990 to May 1992)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Minimum Wage	-0.38**	-0.41**	-0.36**	-0.40**	---	---	---	---
	(0.05)	(0.05)	(0.05)	(0.05)				
Minimum Wage		---	---	---	-0.10**	-0.11**	-0.09**	-0.11**
					(0.01)	(0.01)	(0.01)	(0.01)
Log of Average Adult Wage	-0.06	-0.06	-0.05	-0.05	---	---	---	---
	(0.05)	(0.07)	(0.07)	(0.07)				
Average Adult Wage		---	---	---	-0.004	-0.004	-0.003	-0.003
					(0.006)	(0.006)	(0.006)	(0.006)
Proportion of Teenagers in State	2.04**	---	2.03**	---	2.04**	---	2.02**	---
Population	(.43)		(0.43)		(0.44)		(0.44)	
Prime Age Male Unemployment	0.23	0.19	---	---	0.24	0.20	---	---
Rate	(0.17)	(0.17)			(0.17)	(0.17)		
State and Month Effects	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.60	0.58	0.60	0.58	0.60	0.58	0.60	0.58
Elasticity	-0.87	-0.95	-0.84	-0.93	-0.92	-1.01	-0.88	-0.98
N	1,218	1,218	1,218	1,218	1,218	1,218	1,218	1,218

**Significant at the 5 percent level.

Note: The standard errors shown in the parentheses are calculated using the White method to correct for heteroskedasticity (White 1978).

Source: 1990 Survey of Income and Program Participation, January 1990 to May 1992.

Table 3. Effects of Minimum Wage on the Employment to Population Ratio of Various Socio-Economic Groups (Current Population Survey, January 1990 to May 1992)

	Full Sample			Sample with SIPP States Only		
Explanatory Variables	**Prime Age Adults Aged 25-61**	**Teenagers Aged 16 to 19**	**Young Adults and Teenagers Aged 16 to 24**	**Prime Age Adults Aged 25-61**	**Teenagers Aged 16 to 19**	**Young Adults and Teenagers Aged 16 to 24**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Log Minimum Wage	-0.009	-0.21**	-0.11**	-0.01	-0.25**	-0.13**
	(0.01)	(0.04)	(0.03)	(0.01)	(0.05)	(0.04)
Log of Average Adult Wage		-0.006	-0.02**		-0.03	-0.04**
		(0.05)	(0.04)		(0.05)	(0.04)
Log of Average Teenage Wage	-0.002			-0.005		
	(0.008)			(0.01)		
Proportion of Age Groups in the Working Age Population	0.01	.08	0.12	-0.007	0.04	0.11
	(0.04)	(.18)	(0.08)	(0.04)	(.20)	(0.09)
Prime Age Male Unemployment Rate	-0.64**	-0.27**	-0.09	-0.62**	-0.10**	0.07
	(0.05)	(0.14)	(0.09)	(0.05)	(0.16)	(0.10)
State and Month Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.66	0.44	0.46	0.69	0.45	0.47
Elasticity	-0.01	-0.49	-0.19	-0.02	-0.58	-0.23
N	1,479	1,479	1,479	1,218	1,218	1,218

**Significant at the 5 percent level.

Note: The standard errors shown in the parentheses are calculated using the White method to correct for heteroskedasticity (White 1978).

Source: Current Population Survey, January 1990 to May 1992.

Table 4. Effects of Minimum Wage on the Teenage (Aged 16 to 19) Employment to Teenager Population Ratio (Current Population Survey, January 1990 to May 1992)

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Minimum Wage	-0.21**	-0.21**	-0.23**	-0.23**	---	---	---	---
	(0.04)	(0.04)	(0.04)	(0.04)				
Minimum Wage		---	---	---	-0.05**	-0.05**	-0.06**	-0.06**
					(0.01)	(0.01)	(0.01)	(0.01)
Log of Average Adult Wage	-0.005	-0.006	-0.002	-0.002	---	---	---	---
	(0.05)	(0.05)	(0.05)	(0.05)				
Average Adult Wage		---	---	---	-0.0006	-0.0006	-0.003	-0.004
					(0.004)	(0.004)	(0.04)	(0.04)
Proportion of Teenagers in State	0.08	---	0.08	---	0.08	---	0.08	---
Population	(0.17)		(0.18)		(0.18)		(0.18)	
Prime Age Male Unemployment	-0.27**	-0.27**	---	---	-0.27**	-0.27**	---	---
Rate	(0.14)	(0.14)			(0.14)	(0.14)		
State and Month Effects	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Elasticity	-0.49	-0.49	-0.53	-0.54	-0.49	-0.50	-0.55	-0.50
N	1,479	1,479	1,479	1,479	1,479	1,479	1,479	1,479

**Significant at the 5 percent level.

Note: The standard errors shown in the parentheses are calculated using the White method to correct for heteroskedasticity (White 1978).

Source: Current Population Survey, January 1990 to May 1992.

Table 5. Effects of Minimum Wage on the Employment to Population Ratio of Various Socio-Economic Groups (Current Population Survey, January 1979 to December 1992)

Explanatory Variables	Prime Age Adults Aged 25-61 (1)	Teenagers Aged 16 to 19 (2)	Young Adults and Teenagers Aged 16 to 24 (3)
Log Minimum Wage	0.10**	-0.16**	-0.11**
	(0.006)	(0.02)	(0.01)
Log of Average Adult Wage		0.06**	0.08**
		(0.01)	(0.008)
Log of Average Teenage Wage	0.03**		
	(0.004)		
Proportion of Age Groups in the Working Age Population	0.26**	-0.03	0.04
	(0.01)	(0.06)	(0.03)
Prime Age Male Unemployment Rate	-0.72**	-0.61**	-0.54**
	(0.02)	(0.04)	(0.03)
State and Month Effects	Yes	Yes	Yes
Adjusted R^2	0.66	0.49	0.52
Elasticity	0.15	-0.37	-0.19
N	8,568	8,568	8,568

**Significant at the 5 percent level.

Note: The standard errors shown in the parentheses are calculated using the White method to correct for heteroskedasticity (White 1978).

Source: Current Population Survey, January 1979 to December 1992.

Table 6. Effects of Minimum Wage on the Teenage (Aged 16 to 19) Employment to Teenager Population Ratio (Current Population Survey January 1979 to December 1992)

	Monthly Data								Annual May Data	
Explanatory Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)[a]**	**(10)**
Log Minimum Wage	-0.16**	-0.16**	-0.18**	-0.18**	---	---	---	---	0.17**	0.07
	(0.02)	(0.02)	(0.02)	(0.02)					(0.08)	(0.13)
Minimum Wage	---	---	---	---	-0.04**	-0.04**	-0.04**	-0.04**	------	
					(0.005)	(0.005)	(0.005)	(0.005)		
Log of Average Adult	0.06**	0.06**	0.08**	0.08**	---	---	---	---	-0.03	0.10
Wage	(0.01)	(0.01)	(0.01)	(0.01)					(0.04)	(0.06)
Average Adult Wage	---	---	---	---	0.005**	0.005**	0.007**	0.007**	------	
					(0.001)	(0.001)	(0.001)	(0.001)		
Proportion of Teenagers in	-0.03		-0.02		-0.04		-0.02		-0.19	-0.40**
State Population	(0.06)		(0.06)		(0.06)		(0.06)		(0.22)	(0.20)
Prime Age Male	-0.61**	-0.61**			-0.61**	-0.61**			-0.54**	-0.49**
Unemployment Rate	(0.04)	(0.04)			(0.04)	(0.04)			(0.11)	(0.16)
State and Month Effects	yes	yes	yes	yes	yes	yes	yes	yes	yes [b]	yes [b]
Adjusted R^2	0.49	0.49	0.47	0.47	0.49	0.49	0.47	0.49	0.72	0.43
Elasticity	-0.37	-0.37	-0.41	-0.41	-0.32	-0.32	-0.36	-0.36		
N	8,568	8,568	8,568	8,568	8,568	8,568	8,568	8,568	753	714

[a]This column comes from Card and Krueger (1995), Column 5, Table 7.1 p 212 . It is based on annual May CPS data from 1973 through 1989.

[b]State and Year Effects.

**Significant at the 5 percent level.

Note: The standard errors shown in the parentheses are calculated using the White method to correct for heteroskedasticity (White 1978)

Source: Current Population Survey , January 1979 to December 1992.

Appendix Table 1A. Means and Standard Deviations for Table 1
(1990 Survey of Income and Program Participation, January 1990 to May 1992)

Variables	Prime Age Adults Aged 25 to 61 (1)	Teenagers Aged 16 to 19 (2)	Young Adults and Teenagers Aged 16 to 24			Young Adults Aged 20 to 24	
			All (3)	Black (4)	Non-Black (5)	High School Graduate (6)	Non-High School Graduate (7)
Employment to Population Ratio	0.71	0.43	0.56	0.39	0.59	0.71	0.44
	(0.07)	(0.16)	(0.12)	(0.23)	(0.12)	(0.13)	(0.24)
Log Minimum Wage	1.39	1.39	1.39	1.39	1.39	1.39	1.39
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Log of Average Adult Wage	---	2.41	2.41	2.41	2.41	2.41	2.41
		(0.16)	(0.16)	(0.17)	(0.16)	(0.16)	(0.17)
Log of Average Teenage Wage	1.60	---	---	---	---	---	---
	(0.90)						
Proportion of Age Groups in the Working Age Population	0.79	0.09	0.21	0.04	0.07	0.10	0.02
	(0.03)	(0.02)	(0.03)	(0.04)	(0.04)	(0.03)	(0.01)
Prime Age Male Unemployment Rate	0.04	0.04	0.04	0.04	0.04	0.04	0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Number of States	42	42	42	33	42	41	34
N	1,218	1,218	1,218	957	1,218	1,189	986

Note: Standard Deviation reported in brackets.

Source: Survey of Income and Program Participation, January 1990 to May 1992.

Appendix Table 2A. Means and Standard Deviations for Table 3
(Current Population Survey, January 1990 to May 1992)

Variables	Full Sample			Sample with SIPP State Only		
	Prime Age Adults Aged 25-61 (1)	Teenagers Aged 16 to 19 (2)	Young Adults and Teenagers Aged 16 to 24 (3)	Prime Age Adults Aged 25-61 (4)	Teenagers Aged 16 to 19 (5)	Young Adults and Teenagers Aged 16 to 24 (6)
Employment to Population Ratio	0.70 (0.06)	0.43 (0.15)	0.56 (0.11)	0.70 (0.06)	0.42 (0.14)	0.56 (0.10)
Log Minimum Wage	1.39 (0.08)	1.39 (0.08)	1.39 (0.08)	1.39 (0.08)	1.39 (0.08)	1.39 (0.08)
Log of Average Adult Wage	---	2.41 (0.14)	2.41 (0.14)	---	2.41 (0.13)	2.41 (0.13)
Log of Average Teenage Wage	1.58 (0.15)	---	---	1.58 (0.15)	---	---
Proportion of Age Groups in the Working Age Population	0.80 (0.03)	0.09 (0.02)	0.20 (0.03)	0.80 (0.03)	0.09 (0.02)	0.20 (0.03)
Prime Age Male Unemployment Rate	0.04 (0.03)	0.04 (0.03)	0.04 (0.03)	0.04 (0.02)	0.04 (0.02)	0.04 (0.02)
Number of States	51	51	51	42	42	42
N	1,479	1,479	1,479	1,218	1,218	1,218

Note: Standard Deviation reported in brackets.

Source: Current Population Survey, January 1990 to May 1992.

Appendix Table 3A. Means and Standard Deviations for Table 5 and Table 6 (Current Population Survey, January 1979 to December 1992)

	Monthly Data			Annual Data
Variables	Prime Age Adults Aged 25-61 (1)	Teenagers Aged 16 to 19 (2)	Young Adults and Teenagers Aged 16 to 24 (3)	Teenagers Aged 16 to 19 (4)
Employment to Population Ratio	0.67 (0.07)	0.44 (0.14)	0.56 (0.11)	0.43 (0.13)
Log Minimum Wage	1.24 (0.11)	1.24 (0.11)	1.24 (0.11)	1.25 (0.11)
Log of Average Adult Wage	---	2.20 (0.21)	2.20 (0.21)	2.19 (0.21)
Log of Average Teenage Wage	1.41 (0.21)	---	---	---
Proportion of Age Groups in the Working Age Population	0.76 (0.04)	0.10 (0.02)	0.24 (0.04)	0.10 (0.02)
Prime Age Male Unemployment Rate	0.05 (0.03)	0.05 (0.03)	0.05 (0.03)	0.05 (0.03)
Number of States	51	51	51	51
N	8,568	8,568	8,568	714

Note: Standard Deviation reported in brackets.

Source: Current Population Survey, January 1979 to December 1992.

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