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ABSTRACT

Minimum Wage Effects in the Longer Run*

Exposure to minimum wages at young ages may lead to longer-run effects. Among the possible adverse longer-run effects are decreased labor market experience and accumulation of tenure, lower current labor supply because of lower wages, and diminished training and skill acquisition. Beneficial longer-run effects could arise if minimum wages increase skill acquisition, or if short-term wage increases are long-lasting. We estimate the longer-run effects of minimum wages by using information on the minimum wage history that workers have faced since potentially entering the labor market. The evidence indicates that even as individuals reach their late 20's, they earn less and perhaps work less the longer they were exposed to a higher minimum wage, especially as a teenager. The adverse longer-run effects of facing high minimum wages as a teenager are stronger for blacks. From a policy perspective, these longer-run effects of minimum wages are likely more significant than the contemporaneous effects of minimum wages on youths that are the focus of most research and policy debate.

JEL Classification: J22, J23, J38

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I. Introduction

Exposure to a high minimum wage during the first years in which youths enter the labor market may generate adverse effects that persist in the longer run. If so, then an exclusive focus on contemporaneous, short-run effects of minimum wages on youths—which is a reasonable characterization of most research and policy debate on minimum wages—may miss significant components of the potential effects of minimum wages.

How might the longer-run effects of minimum wages arise? Most directly, perhaps, the shorter-run effects of minimum wages on youths that have been studied so extensively can have lasting impacts that extend into adulthood. If minimum wages lower training among young workers, reduce the accumulation of labor market skills and experience by deterring employment of young, unskilled individuals, and discourage school enrollment—all effects that have been documented in the literature, although not without some controversy—then we might expect more lasting adverse effects on both wages, employment, and other labor market outcomes.[1] These effects could be exacerbated by factors sometimes interpreted as the "scarring" effects of non-employment at young ages (e.g., Ellwood, 1982), which amplify the consequences of reduced early labor market experience, perhaps including entry into illicit activities. On the other hand, longer-run effects that counter some of the adverse short-run effects are also possible. Minimum wages could lead to increased skill acquisition if a higher wage floor raises the productivity level necessary for a worker to be employable.[2] And the short-term wage increases stemming from minimum wages could have persistent effects.

In this paper we explore the longer-run effects of minimum wages. Of course, research on the effects of minimum wages on training and schooling implicitly addresses the longer-run effects of

[1] The employment effects literature is well known and extensive. For evidence on the effects of minimum wages on training see Hashimoto (1982), Acemoglu and Pischke (2003), Grossberg and Sicilian (1999), Fairris and Pedace (2003), and Neumark and Wascher (2001). For evidence that minimum wages reduce school enrollment, see Chaplin, et al. (2003) and Neumark and Wascher (2003); earlier, more ambiguous evidence is presented in Ehrenberg and Marcus (1982), Mattila (1978), and Ragan (1977).

[2] See, for example, Cunningham's (1981) discussion of the possible positive effects of minimum wages on the decision of teenagers to stay in school or acquire more schooling. Although increased schooling is possible, predictions are ambiguous for a number of reasons, including that raising the wage floor for unskilled workers could reduce the return to education.

minimum wages, because, for example, teens who leave school will on average have lower schooling as adults. What is different and unique in this paper is the direct estimation of these longer-run effects.[3] Instead of simply asking how outcomes such as employment, wages, etc., among 16-19 year-olds are affected by contemporaneous minimum wages, we estimate the effects of the history of exposure to a higher minimum. Most significantly, although we would not expect much effect of current minimum wages on labor market outcomes for, say, 25-29 year-olds, contemporaneous outcomes for these older individuals may reflect the consequences of earlier exposure to minimum wages. In particular, past exposure to higher minimum wages when they were younger—when minimum wages were more binding—would be expected to have the strongest effects. Thus, the empirical approach addresses how, in the longer run, individuals and workers are affected by exposure to high minimum wages—particularly exposure during their youth.

II. Data

Our data set comes from the Current Population Survey (CPS) Outgoing Rotation Group (ORG) files for the years 1979-2001. We first extract data on individuals aged 16-29. We then aggregate these data to the state-year-age cell, giving us measures of averages in these cells (using CPS earnings weights),[4] and we append to these cells information on state and federal minimum wages.

To be able to study the longer-run effects of exposure to minimum wages, it is necessary to characterize the minimum wage "history" that each individual has faced. Because state-level variation in minimum wages is important in obtaining better statistical experiments, this history is characterized in terms of the higher of the state or federal minimum. The strategy used is to construct the history of

[3] The only other paper of which we are aware that attempts to estimate longer-run effects of minimum wages is a study by Behrman, et al. (1983), who use Social Security earnings records to study the effects of time-series variation in the minimum wage on various measures of the earnings distribution. They incorporate a distributed lag of minimum wage effects, but do not distinguish, as we do here, effects of minimum wages at young ages when minimum wages were most likely to be binding—and their sample includes individuals up to 65 years old. Baker, et al. (1999) study the effects of minimum wages on teenagers, but focus on the employment effects that arise with relatively long lags. Although their work does not speak to the effects on adults of minimum wages experienced as teens, it does emphasize that minimum wage effects may arise over a longer run than is typically assumed in studies of the effects of minimum wages on employment and other outcomes.

[4] In the regressions we estimate, we always weight by the number of observations used to construct these cell averages, multiplied by the average CPS earnings weight for the cell to account for over- or under-sampling of states.

minimum wages in the state in which the individual currently resides. This is a potential limitation, because with some migration from state to state the minimum wage history based on the current state of residence will measure the true minimum wage history with error.[5] Longitudinal data that followed individuals as they moved from state to state would better capture their minimum wage history, but would perhaps be more plagued by the endogeneity of migration.[6,7]

The specifications estimated below use three different measures of the minimum wage. The first—paralleling the typical study of contemporaneous, short-run effects of minimum wages—is a measure of the gap between the state minimum wage (when it is higher) and the federal minimum wage for each state-year-age cell. This state minimum wage gap is measured as the ratio of the state to the federal minimum, minus one, so in a year when the state minimum is 10 percent higher than the federal minimum, for example, the gap is 0.1. This measure focuses on the state minimum wage relative to the federal; the time-series variation induced by the federal minimum is swept out by the inclusion of year effects in the regressions. The second measure captures not just whether the minimum wage is currently high, but also the history of the minimum wage to which an individual has been exposed, by measuring years of exposure to a high minimum wage weighted by this gap in each year. Finally, in what we regard as the most informative specifications toward which some of our earlier analyses build, we distinguish

[5] According to the Census Historical Migration Database, in each year over the period 1979-2001, 15-17 percent of the population changed place of residence. Of this total migration, 95-97 percent is migration within the United States. On average, 80 percent of domestic migrants change their residence within the same state, and the rest (20 percent) migrate to a different state. Thus, approximately 2.7-3.0 percent of the population moves to a different state each year. (See http://www.census.gov/population/socdemo/migration/tab-a-1.txt.) Later, we report results from the 1990 PUMS indicating that about 13 percent of 20-24 year-olds and 16 percent of 25-29 year-olds moved between states in the previous five years.

[6] Yet another possibility would be to instrument for the measured minimum wage history in the state of residence with the history in the state of birth (pegged to the same birth cohort), thus isolating the exogenous variation in the minimum wage history faced by individuals. In the CPS, however, data on state of birth are not available. Furthermore, while we have little doubt that this instrument would explain a great deal of variation in the minimum wage history based on state of residence—given relatively low inter-state migration—its exclusion from the equations we estimate would be questionable, as unmeasured factors associated with the state of birth might affect the labor market outcomes we study through channels other than the minimum wage history.

[7] This discussion suggests that the NLSY79 might be of some use for this research, by providing longitudinal information including state of residence for a cohort of teenagers as they age into their 30's. However, most of the cross-state variation in minimum wages on which our identification relies begins in 1987 (as reported below in Table 2). Given that the NLSY79 cohort was aged 14-22 in 1979, none are teenagers as of 1987. There is also the NLSY79 Young Adult file, based on the offspring of the mothers in the NLSY79. This began in the mid-1990s with teenagers, and at this point there are very few observations on individuals in their 20's (Center for Human Resource Research, 2002, Chapter 3).

between exposure at younger ages when minimum wages should have been more binding and exposure at older ages.

In constructing these minimum wage measures, we begin by assuming that the relevant years for capturing exposure to a high minimum are from age 16 to the present age. Then, for any state-year-age cell, we can count up the number of years from age 16 to the current age in which the minimum wage exceeded the federal minimum wage in the state, weighting each year by the state minimum wage gap. A few tables help to illustrate how this is done, and to document some of the resulting variation.

The CPS ORG files start in 1979, but we use information on minimum wages going back to 1973. To avoid the potential confounding influences of the Vietnam War on youth labor markets we do not go back earlier than 1973, when the draft and U.S. involvement in the war ended. As a consequence, the only birth cohorts we can consider for 1979 are the cohorts that were age 16 or younger in 1973, or those who were 22 or younger in 1979. Table 1 arrays the ages and years that can then be covered by our analysis. The first cohort—those aged 16 in 1973—are 22 in 1979, 23 in 1980, etc. The second cohort—those aged 16 in 1974—can be picked up at an age one year younger. And the seventh cohort—those aged 16 in 1979—can be covered for the full set of years.[8] Then, toward the end of the sample period, we lose observations on later cohorts at older ages. For example, the 29th cohort is 16 in 2001, and that is the last year of data for which they are covered. Of course, we do not have the actual longitudinal observations on members of these cohorts as they age. But we can infer the effects of minimum wages on these cohorts at different ages because the CPS repeatedly draws random samples from these cohorts as they age.[9]

Table 2 reports federal minimum wages for the sample period, and all state minimum wages that

[8] We explored the sensitivity of the results to using information on minimum wages back to 1966 and hence covering all cohorts back to age 16. The results were very similar.

[9] In principle we could look at individuals past age 29. However, for older individuals the minimum wage history that would be used to identify the effects of exposure to minimum wages at young ages comes from the early part of the sample period, when there was not much state variation in minimum wages. For example, looking at Table 1, the latest birth cohort of 34 year-olds is cohort 11, which left its teens by 1987, which is when most of the state variation in minimum wages began. In addition, as Table 1 illustrates, even with 22 years of data we would get relatively few complete sets of observations on cohorts for these older individuals all the way back to age 16.

exceeded the federal minimum wage. The minimum is defined as of May of the calendar year; we chose this date because the greatest number of state minimum wage increases occurred in April (followed by January). Table 2 displays considerable variability in the level of state minimum wages, with some states in some years having a minimum only a shade higher than the federal minimum,[10] and other states and years with minimums exceeding the federal minimum by well over a dollar. This variation is the motivation for weighting the years of exposure to a higher minimum wage by the state minimum wage gap.

Table 3 provides some examples as to how this information is used to compute the years of exposure to a higher minimum wage. We do not display the weighting by the state minimum wage gap, which is a simple extension but would complicate the table. The first example covers Oregon, where a higher minimum wage was first enacted in 1990, and remained in effect through the rest of the sample period. Given this, years of exposure for all age groups were zero through 1989. Then in 1990 all age groups have one year of exposure, in 1991 16 year-olds have one year of exposure and 17-29 year-olds have two years of exposure, etc. Pennsylvania provides a different type of example, as a state minimum wage higher than the federal minimum was enacted in 1989, but in 1990 the federal minimum caught up to the state minimum and a higher state minimum was never passed subsequently. So in this case years of exposure jumps to one for all ages (16-29) in 1989. In 1990 years of exposure reverts to zero for 16 year-olds, and is one for all other ages, and so on. Finally, Washington's experience is more complicated because a higher state minimum comes on line, the federal minimum then catches up, and a higher state minimum is subsequently enacted again. These are examples, but as Table 2 shows, there is considerable variation in exposure, with some cohorts exposed to higher minimum wages in every year beginning at age 16, others with fewer but still many years of exposure to a higher minimum, and some with very few years of exposure; in addition, there are many observations in states with no exposure to higher minimum wages.

[10] For example, the state minimum wage in Connecticut was only one or two cents above the federal minimum from 1974 through 1987 as a result of legislation mandating a state minimum 0.5 percent above the federal level.

Table 4 reports some descriptive statistics for the sample, broken down for the three age groups studied. The number of observations for the whole sample for each age group comes from taking the number of times any single-year age appears in Table 1, multiplied by 51. For example, between 1979 and 2001 ages 16 through 19 appear 92 times, which multiplied by 51 yields 4,692.

The four outcome variables we study are wages, employment, hours, and earnings. In studying weekly hours of work and weekly earnings, we do not condition on employment, so that in the regression models described below we estimate the overall effects of minimum wages on hours and earnings. It is important to look at total hours and not just employment because employment could fall but hours conditional on employment rise, with ambiguous net effects on the total amount of labor hired.[11] Similarly, looking at earnings without conditioning on employment gives us a summary measure of the overall effects of minimum wages on workers' earnings.

Employment is simple to define, but the construction of wages, hours, and weekly earnings is more complicated because of apparently bad data, missing data for those who report that they are working, etc. As a consequence, there are sometimes fewer valid observations on individuals for these other outcomes.[12] However, in the full sample it turns out that in each single-year age group in each state and year there are always individuals with valid measurements on each outcome, so that the sample size for the data collapsed to state-year-age cells is always the same. But in analyses disaggregated by race (discussed later) this is not always the case.

In Table 4, to provide some information on how the exposure variables vary, the descriptive statistics are broken down by whether or not the current state minimum wage exceeds the federal minimum. Not surprisingly, mean exposure is higher in the group of observations in which the current

[11] Past research has sometimes looked at outcomes such as hours conditional on employment, part-time status, etc., to explore whether employers respond to minimum wages by reducing employment but increasing hours, hence economizing on the fixed costs of employment (such as some benefits). Our interest in this paper, though, is in the overall benefits or costs to workers of minimum wages, so the unconditional estimates are the most pertinent. Some evidence on the effects of minimum wages on hours of work is reported in Gramlich (1976), Brown, et al. (1983), Cunningham (1981), and Michl (2000).

[12] In general, those who reported working last week or with a job but not working last week are considered as employed. Wages are treated as invalid if they are below one half of the federal minimum or above $100 (in 2001 dollars).

state minimum exceeds the federal. For example, for teenagers the mean years of exposure for this group is 2.21 years, compared with 0.03 years for the other observations; it exceeds zero for these latter observations because in past years the state minimum sometimes exceeded the federal minimum in some states, but it is close to zero because many states never had a higher minimum.

The same pattern holds for the exposure measure weighted by the gap between the state and the federal minimum wage, reported in the next row. For teenagers, the mean weighted exposure measure is 0.243 in the states with a current higher minimum, versus only 0.003 for the other states. Note that the 0.243 figure does not imply that the average state minimum wage gap is 24.3 percent, as the gap is also weighted by the number of years of exposure. This is clear from the figures reported for the older age groups, where the mean weighted exposure measure rises to 0.557 for 20-24 year-olds in states with a higher minimum, and 0.806 for 25-29 year-olds. To clarify this further, the following row simply reports the mean contemporaneous state minimum wage gap, which does not weight by years of exposure.[13]

Looking at the descriptive statistics on these outcomes, for the 16-19 year-olds employment is lower in the states with high minimum wages, and wages are higher, consistent with minimum wages raising wages and lowering employment contemporaneously. Hours are also a shade lower, but weekly earnings are higher, suggesting that the wage gains offset the employment and hours differences. The employment difference is smaller for the 20-24 year-old group, and for 25-29 year-olds employment is actually a shade higher in the states with high minimum wages, consistent with minimum wages having a stronger contemporaneous disemployment effect on younger individuals. But the wage and earnings differences increase with age, which suggests that this is not the entire explanation. Regardless, though, these are univariate comparisons and hence are not intended as estimates of the effects of minimum wages. In particular, they do not take into account variation in the minimum wage gap or the cumulative effects of past minimum wages, nor do they account for other factors controlled for in the regression estimates that follow.

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[13] The mean contemporaneous state minimum wage gap differs slightly by age only because of small differences in the years represented in each age group; see Table 1.

The final row of the table shows the percentage at or below the minimum wage. Not surprisingly, of course, this percentage is highest for teenagers, consistent with their lower wages, and falls sharply with age. Notice, also, that for each age group the percentage at or below the minimum is lower in the states with high minimum wages than in the other states, indicating that state minimum wages tend to be implemented in higher wage states. This is why, as explained below, it is important to control for persistent differences in the levels of wages (and other variables) across states. However, we verified that for high minimum wage states, relative to other periods for the same states when the minimum wage was non-existent (or lower), the higher minimum is associated with a higher percentage at or below the minimum (i.e., the within-state correlation is positive), which is the critical identifying information used in the empirical analysis.

III. Empirical Methods

The analysis begins with simple specifications for the effects of a contemporaneous high minimum wage on wages, employment, hours, and earnings. These specifications are of the form

$$(1) \qquad Z_{ijt} = \alpha + \beta MW_{it} + S_i\theta_S + Y_t\theta_Y + A_j\theta_A + \varepsilon_{ijt} \; .$$

In equation (1), 'i' indexes states, 'j' indexes single-year age groups, and 't' indexes years. Z is alternatively: the log average wage of workers in the state-year-age cell; the percentage employed in the cell; the average hours worked of all individuals in the cell; and the log average weekly earnings of all individuals in the cell. MW is the proportional gap between the state minimum wage and the federal minimum. S, Y, and A are vectors of state, year, and age dummy variables, respectively. Controls are not included for productivity-related characteristics that are potentially endogenous, such as schooling, because we do not want to control for variation in these characteristics that may be driven by minimum wages; instead, we want to obtain reduced-form estimates that capture both direct effects on wages (for example), as well as indirect effects via the accumulation of skills.

The state dummy variables account for persistent state-level differences in the dependent variables (such as higher-wage states). The year dummy variables sweep out common changes across all states that could be caused by federal minimum wage changes, but could also be driven by changes in aggregate economic conditions that are correlated with minimum wage changes. With the year dummy variables included, no identifying information comes from variation in the federal minimum wage. Instead, any effects of exposure to higher minimum wages are identified from variation in state minimum wages above the federal minimum.[14]

Observations within state-year cells for different single-year age groups may be non-independent, as, for example, economic conditions affect age groups similarly. Furthermore, Bertrand, et al. (2002) have underscored the potential for understated standard errors in panel data sets when errors are positively serially correlated and the "treatment" (in this case the minimum wage) is positively serially correlated. To account for this serial correlation as well as possible non-independence across age groups, we adopt a very conservative approach and use standard errors robust to arbitrary correlation patterns among all observations for each state—i.e., across age or time—as well as arbitrary heteroscedasticity across states.[15]

Equation (1) is estimated for three age groups: 16-19 year-olds; 20-24 year-olds; and 25-29 year-olds. Minimum wage research has usually focused on the first group—teenagers—as those most likely to be adversely affected by minimum wages, because teenagers have generally accumulated few skills and therefore are strongly over-represented among minimum wage workers. This conjecture can also be examined in the framework used here, when we estimate the effects of the contemporaneous minimum wage. In contrast, the older group is unlikely to be affected by current minimum wages, but is of greater interest in looking at the effects of past exposure to high minimum wages, using the specifications explained next.

The first approach to estimating the longer-run effects of minimum wages is to substitute for the

[14] As noted earlier, most of the state-level variation in minimum wages begins in 1987. Earlier, state minimum wages also acted, in some cases, to extend coverage to workers not covered by federal minimum wages. But given that federal minimum wage coverage was nearly universal by 1979 (Brown, 1999)—or by 1985 if account is taken of coverage of state and local government workers—our estimates should be interpreted as largely identifying the effects of changes in minimum wage levels, rather than the effects of changes in coverage.

[15] Allowing correlation across time also accounts for the non-independence stemming from overlapping samples in the CPS.

contemporaneous minimum wage variable in equation (1) a measure of the number of years, beginning at age 16, that the individual was exposed to a minimum wage higher than the federal level, with the number of years of exposure weighted by the state minimum wage gap, using the specification

$$(2) \qquad Z_{ijt} = \alpha + \gamma EXP_{ijt} + S_i\theta_S + Y_t\theta_Y + A_j\theta_A + \varepsilon_{ijt} \ ,$$

where EXP is the weighted years of exposure measure.[16]

This equation, too, is estimated for the three different age groups. In this specification γ identifies the effect of exposure to high minimum wages.[17] Because year effects are included, this effect is identified relative to whatever common movements in the exposure variable were generated by variation in the federal minimum.

Finally, equation (2) is modified by dropping the restriction that years of exposure have equal effects on the dependent variables regardless of when they occurred. In particular, equation (2) is augmented to include separate measures of exposure during each age range. For example, for the 25-29 year-olds the specification is

$$(3) \qquad Z_{ijt} = \alpha + \gamma_1 EXP1619_{ijt} + \gamma_2 EXP2024_{ijt} + \gamma_3 EXP2529_{ijt} + S_i\theta_S + Y_t\theta_Y + A_j\theta_A + \varepsilon_{ijt} \ .$$

The three variables EXP1619, EXP2024, and EXP2529 measure weighted years of exposure to a higher minimum during the specified age ranges. When this specification is estimated for 20-24 year-olds, EXP2529 is of course dropped. For 16-19 year-olds we would also drop EXP2024, in which case this specification would be equivalent to equation (2), reflecting the fact that the question of the effects of exposure at earlier ages for the youngest age group is nonsensical; consequently this specification is not

[16] Note that because equation (2) includes state dummy variables and is estimated for separate age groups, it allows for differences across states in the age profiles of the dependent variables. Thus, the findings we obtain cannot be attributable to fixed differences in these age profiles between states that are correlated with the minimum wage variable. Similarly, the inclusion of the year dummy variables allows for shifts in the age profiles of the dependent variables over time.

[17] We also estimated specifications with a contemporaneous minimum wage variable and the exposure variable. The conclusions were very similar but more complicated to present and interpret, in part because there are always two cases for the same level of exposure—with and without a current high minimum—and in part because the contemporaneous minimum wage variable, conditional on a given level of exposure, also captures information about the time pattern of exposure to a higher minimum.

estimated for 16-19 year-olds.

The motivation for specification (3) is straightforward. Whatever the consequences of minimum wages—reducing employment directly, lowering training, etc.—they are likely to be more severe when the minimum wage is more binding. Suppose, for example, that a negative effect on wages of exposure to a higher minimum wage stems from reduced labor market experience (which we cannot measure directly in the CPS). Any such reduction is likely to have been stronger if the exposure occurred when an individual was younger, rather than older, because the disemployment effects of minimum wages are likely to be strongest for the youngest and therefore least-skilled individuals (which turns out to be the case based on estimates of equation (1)). Equation (3) therefore tests whether exposure to higher minimum wages when an individual was young indeed generates stronger longer-run effects.

Finally, among a variety of alternative cuts of the data we consider, we report estimates disaggregating the observations by race (looking at whites and blacks). It has often been conjectured that the effects of minimum wages on minorities will be stronger because their wage levels are lower—whether because of lower productivity or discrimination—and hence a minimum wage is more binding, although the existing literature on minimum wage employment effects (mainly older time-series studies) does little to establish stronger disemployment effects for minorities (Brown, 1999).[18] Here, though, we are asking a quite different question about minimum wages and we are using more recent data and state-level variation in minimum wages, so the race difference merits revisiting.

IV. Results

Contemporaneous Minimum Wage Effects

The first regression results are reported in Table 5. For each dependent variable, estimates of equation (1)—which includes only the contemporaneous state minimum wage gap—are reported first, in columns (1)-(4), followed by estimates of equation (2)—which uses instead the weighted simple exposure measure—in columns (5)-(8). The estimates in columns (1)-(4) correspond to the types of specifications

[18] Linneman (1982) uses a different approach, and finds similar contemporaneous effects of minimum wages on earnings of blacks and whites.

that have frequently been estimated in the newer research on minimum wages using state-level variation for identification (in contrast to the older time-series literature).

Looking at the "baseline" specifications in columns (1)-(4), the estimates in the first column are consistent with a positive and significant effect of minimum wages on wages of teenagers. Given that the average state minimum wage gap in states with a high minimum wage is 0.112, multiplying the estimated minimum wage coefficients by 0.112 yields the effect of an "average" higher state minimum wage. The estimated wage effect for teenagers in column (1) therefore implies that imposing the average state minimum wage results in wages for teenagers that are higher by about 2.2 percent ($0.112 \cdot 0.202 = 0.023$ log points), implying an elasticity of approximately 0.21. Existing research has reported elasticities of wages near the minimum with respect to minimum wages, and found higher values, but the 0.21 figure is an average across all teens—many of whom earn above the minimum wage.[19] Reflecting the considerably lower share of 20-24 and 25-29 year-olds at the minimum, the estimated wage effects for these older age groups are near zero, and statistically insignificant.

Column (2) reports estimates of the similar specification for employment. There is evidence of a significant negative employment effect for teenagers. With an estimated coefficient of −8.33, the implied elasticity is −0.18 (−8.33 multiplied by the average minimum wage gap for teens of 0.112, coupled with an average employment rate of 46.5 percent for teenagers, implies a 2.0 percent decline in employment, which with an 11.2 percent higher minimum wage yields the −0.18 elasticity); this elasticity is within the range of existing estimates of the elasticity of teen employment with respect to minimum wages. The estimates for the older groups are not statistically significant, and only for 20-24 year-olds is the estimate negative. Column (3) looks at hours worked. The hours effects parallel the employment effects, with the estimates indicating a significant negative effect only for teenagers (and an elasticity of −0.17).

Finally, column (4) looks at weekly earnings. Here, for teenagers especially, there are anticipated offsetting effects as higher wages compete with lower employment or hours. In fact this is borne out in

[19] Neumark, et al. (2004) find a contemporaneous wage elasticity for minimum wage workers of around 0.8, falling to 0.4 or less for workers more than 10 percent above the minimum but still near the minimum.

the estimates, which suggest that a higher contemporaneous minimum wage has little or no effect on average earnings, either for teenagers or for the other age groups. The specifications in columns (1)-(4) (especially for employment) most closely parallel other estimates of minimum wage effects in the literature.

Exposure Estimates

The estimates discussed thus far do not address the issue of the effects of cumulative exposure to a higher minimum, and hence the longer-run effects of the minimum wage. This issue is first taken up in the last four columns of Table 5. The results for log wages, in column (5), indicate significant positive effects of exposure to a high minimum wage for teenagers; of course for teenagers this exposure is, by construction, fairly contemporaneous. For both the 20-24 and 25-29 year-olds the estimated longer-run effect of exposure to a higher minimum is negative, but it is significant (at the ten-percent level) only for 25-29 year-olds. The estimates in column (5) of Table 5 imply that 25-29 year-old workers exposed to the mean weighted years of exposure (0.806) in high minimum wage states earn wages that are lower by 3.1 percent.[20]

Turning to the employment and hours results, in columns (6) and (7), the estimated exposure effects are negative for all three age groups for both employment and hours, although only the hours estimate for 16-19 year-olds is statistically significant (at the ten-percent level). The hours estimate for 16-19 year-olds implies that an individual exposed to the mean weighted exposure in a high minimum wage state has hours that are lower by 0.27 hour, using the mean weighted exposure of 16-19 year-olds in high minimum wage states of 0.243 (Table 4).

Finally, column (8) reports the earnings effects. In this case for teenagers there is a positive but insignificant exposure effect. For the older groups, for which the exposure effects are of more interest, both estimates are negative, with the estimate for 25-29 year-olds significant at the ten-percent level. For this oldest group, the estimates imply that an individual exposed to the mean weighted exposure in high

[20] This calculation comes from multiplying the coefficient of −0.038 times the mean weighted exposure for 25-29 year-olds in high minimum wage states of 0.806.

minimum wage states earns 4.9 percent less because of exposure to a higher minimum wage.[21]

Exposure at Younger versus Older Ages

Given that minimum wages are more binding at younger ages, their contemporaneous effects should be greatest when individuals are young, and therefore their longer-run effects should be strongest for exposure at young ages. Estimates of equation (3), examining this issue, are reported in Table 6. To summarize briefly, the evidence nearly always points to particularly adverse effects of exposure to higher minimum wages at younger ages.

Looking first at wages, for both 20-24 and 25-29 year-olds the estimates for exposure at younger ages are negative in all three cases, and are considerably larger (in absolute value) and statistically significant for exposure at ages 16-19.[22] The estimate for 25-29 year-olds is particularly large, with the estimated coefficient of −0.124 implying that each year of exposure to the average state minimum wage gap during the ages 16-19 reduces "adult" wages by about 1.4 percent (0.112·0.124). This evidence points to adverse longer-run effects of exposure to high minimum wages during one's first few potential years in the labor market.

The evidence on employment and hours, although a bit weaker statistically, similarly points to adverse longer-run effects of exposure to a high minimum wage when young. For the two outcomes, for 20-24 year-olds and 25-29 year-olds, in three out of four cases there is statistically significant evidence (although sometimes only at the ten-percent level) of negative effects of exposure to higher minimum wages at young ages (16-19). To put these estimates in perspective, for example, for 20-24 year-olds each year of exposure to the average state minimum wage gap during the teenage years reduces hours by about 0.25 hour, or 1.0 percent, and for 25-29 year-olds the corresponding figures are 0.16 hour or 0.5

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[21] Table 2 indicates that Alaska, Connecticut, and the District of Columbia have had higher state minimum wages for the entire sample period, and for considerably longer than any other state. This raises the possibility that the effects of longer-run exposure to a higher minimum wage are disproportionately identified from these three states, which have to generate all of the variation at the high end of the distribution of years of exposure. However, dropping observations from the two states and the District of Columbia had little impact on the estimates, if anything strengthening the conclusions somewhat.

[22] Recall that we do not estimate these specifications for 16-19 year-olds, for whom the estimates would be identical to those in Table 5.

percent. These are relatively small but non-trivial effects.

The final column of Table 6 reports results for earnings. Here, again, there is strong evidence of negative longer-run effects of exposure to minimum wages as a teenager. The estimated longer-run effects for exposure as a teenager are negative and statistically significant for both 20-24 and 25-29 year-olds, and for 25-29 year-olds there is also a negative effect of exposure at ages 20-24 (although smaller and significant at only the ten-percent level). For 25-29 year-olds, for example, each year of exposure to an average higher minimum wage as a teenager is estimated to reduce weekly earnings as an adult by 1.9 percent ($-0.170 \cdot 0.112$).

All told, the general pattern in these estimates is that exposure to higher minimum wages at younger ages has adverse longer-run effects on labor market outcomes.[23] If the longer-run effects stem in part from negative contemporaneous effects of minimum wages at earlier ages, then such findings are expected, as minimum wages are much more likely to have been binding at younger ages. However, these longer-run effects seem most natural with respect to wages or earnings, which should reflect lost training, work experience, etc. It is perhaps less clear why there should be adverse longer-run effects on labor supply, although these could be driven by lower wages, or by consequences of earlier spells of non-employment (or even those of one's peers) that reduce labor market attachment in the longer term.

Interpreting the Estimates

It is instructive to think about the magnitudes of the estimated effects reported in Table 6 to try to understand what might underlie the adverse longer-run effects of minimum wages that we find. Focusing on 25-29 year-olds for concreteness, consider the estimated effects on earnings of exposure to a higher minimum wage as a teenager. As just noted, the earnings estimates suggest that a year of exposure to a representative higher minimum wage as a teenager reduces average "adult" earnings by about 1.9 percent.

[23] These findings are qualitatively consistent with work by Mroz and Savage (2003) indicating that—after accounting for heterogeneity that may generate a correlation between individuals' employment experiences at different ages—early spells of unemployment experienced by youths result in earnings losses that taper off only slowly over time, lowering earnings as much as 10 years later. They also find that spells of unemployment experienced by youths raise the likelihood of future spells of unemployment as much as four years later. However, they do not focus on minimum wage effects per se, and do not distinguish between voluntary and involuntary spells of unemployment.

This seems like a large effect, and it is therefore important to ask how much of it can be potentially explained by the different types of minimum wage effects suggested by the estimates reported in this paper or elsewhere in the existing literature; these are limited to effects of minimum wages on current labor supply, experience, and training and schooling.[24]

The most direct effect would arise through lower current (i.e., adult) employment and hours stemming from exposure to a higher minimum wage as a teen, of which there is evidence in columns (2) and (3) of Table 6. Using the unconditional hours results, which account for both employment and hours variation for the employed, the estimated coefficient on hours of −1.392 implies a 0.49 percent reduction in unconditional hours and hence a similar reduction in earnings.[25] Thus, the contemporaneous labor supply effect accounts for about 26 percent of the earnings decline (0.49/1.9). Of course the source of the contemporaneous employment and hours decline cannot be determined by these data. It may in part reflect lower labor supply in the face of lower adult wages stemming from exposure to a higher minimum wage as a teen, as well as other factors the accumulation of which makes those who were exposed to high minimum wages less likely to be employed or to have hours as high as other workers.

In addition to lower current employment and earnings, the estimates point to foregone labor market experience stemming from disemployment effects in earlier periods. The estimates in Table 5 for 16-19 year olds indicate that a year of exposure to a higher minimum lowers unconditional hours of work for teenagers by 1.9 percent ((−1.962·0.112)/11.88). If each year of full-time experience is worth, say, five percent higher wages, then this implies 0.1 percent (0.05·0.019) lower earnings, on average, for employed individuals,[26] or 0.08 percentage point lower earnings unconditionally, which would account for another 4.2 percent of the earnings decline for 25-29 year-olds (0.08/1.9). Accounting for tenure effects would be expected to increase this effect (which helps justify using a return to experience that may be a bit high), although it is difficult to say by how much since we do not know how this disemployment

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[24] We do not look at the implied effect of exposure to a higher minimum on wages as an "explanation" of the effect on earnings, but instead seek to understand the factors that can reduce both wages and employment or hours.
[25] Lower current hours could also help account for lower wages conditional on working.
[26] That is, 1.9 percent of 25-29 year-olds would have wages lower by five percent.

would have affected later tenure; arguably the effect would be relatively small because young workers change jobs frequently. Thus, foregone experience contributes a little bit, as well, to the overall earnings cost adults bear as a result of exposure to a high minimum wage as teenagers.

On the other hand, the negative effects of minimum wages need not occur solely through reduced employment or hours. If minimum wages also deter training of employed workers, then their adverse effects can extend to those who remained employed as teenagers as well. There is some evidence from CPS data that minimum wages reduce training. The strongest evidence is for formal training, although the stronger evidence of reductions in formal training emerges for 20-24 year-olds rather than 16-19 year-olds. The point estimates suggest sharper reductions in informal training for teenagers, although that evidence is not statistically significant (Neumark and Wascher, 2001). Nonetheless, as a back-of-the-envelope calculation as to how much potential training reductions could contribute to the adverse effects of exposure to a higher minimum wage, the point estimate of the effect of the minimum wage on training of teenagers from Neumark and Wascher (2001) suggests that a representative higher minimum (using the 11.2 percent figure for teens from this paper) reduces the incidence of training by about 1.4 percentage points, or about 7.7 percent. With an estimated return to this training of about 11 percent, this implies an additional 0.15 percent (0.11·0.014) reduction in the average wage;[27] because this estimate comes from a sample that conditions on employment, given the employment rate for this age group this would translate into 0.12 percent reduction in average earnings, implying that together with the effects of current and foregone experience, perhaps as much as 0.69 (the sum of 0.49, 0.08, and 0.12) of the 1.9 percent reduction in average earnings of adults (or 36 percent) can be rationalized via the sources considered thus far.

Another avenue for skill reduction stemming from higher minimum wages comes through school enrollment, where the evidence suggests that minimum wages reduce enrollment of teenagers (Chaplin, et al., 2003; Neumark and Wascher, 2003). Earlier work (e.g., Neumark and Wascher, 1996) suggested that

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[27] The training estimates used in this calculation are from Table 3 (lower panel, column (1')) and Table A1 (column (1')) of Neumark and Wascher (2001).

these enrollment reductions come about as the least skilled teenagers who have already left school are displaced by slightly higher skilled teenagers induced to leave school (often switching from part-time to full-time work) because of the increased demand for them after the minimum wage rises. With respect to schooling, we can simply adopt our regression framework to directly assess the longer-run effects of exposure to a higher minimum on schooling; in contrast, the research just cited focuses on contemporaneous rather than longer-run effects. We did this for 25-29 year-olds, looking at both the percentage with a high school degree or higher level of educational attainment, and years of schooling.[28] For the first measure, the estimated effect of exposure as a teen was negative, but not statistically significant. For years of schooling, there was a negative and significant effect, but for exposure at ages 20-24. Based on these estimates, it is tenuous to attribute any of the adverse longer-run effects of exposure to a higher minimum wage as a teen, in these data, to reduced schooling.

The estimates discussed in this subsection are only intended to be suggestive. They do suggest, though, that standard labor supply and human capital channels—such as lower current employment and hours, reduced training, and foregone work experience as a teenager—can probably explain a sizable share but not all of the longer-run effects of minimum wages that we find. These longer-run effects may also arise in part from factors such as the scarring effects of early non-employment, deleterious effects of illicit activities, and, more generally, influences that amplify the consequences of the more commonly studied effects of minimum wages (such as employment reductions), possibly including peer effects. Indeed, it appears difficult to account for the magnitudes of the longer-run effects of minimum wages that we estimate without appealing to additional factors like these.

Effects of Exposure by Race

Next, we turn to results estimated separately for whites and blacks.[29] As a preliminary, Table 7 reports some descriptive statistics for whites and blacks. These reveal lower average wages for blacks, especially at the older ages, as well as lower employment, hours, and earnings for blacks. Interestingly,

[28] It is less appropriate to estimate these models for younger individuals, for whom schooling may not be completed.
[29] In all of our analyses using the CPS that do not distinguish by race, we include all observations. Here we include only whites and blacks.

for teenagers the share of blacks at or below the minimum is lower than for whites. As indicated by the descriptive statistics at the top of the table for the state minimum wage gap, this is not because blacks and whites are exposed to very different minimum wages. Rather, the answer lies in the much lower employment rates for blacks, suggesting that far fewer blacks whose wages would be bound by the minimum remain in the workforce. Thus, the lower employment rate coupled with the lower wages of those blacks who do work is consistent with minimum wages being more binding for blacks because of their lower potential wages, despite the lower share black at the minimum; the results described below confirm this in a multivariate setting.

As further preliminary evidence, Panel A of Table 8 reports the contemporaneous specification (equation (1)) for teenagers, simply to shed some light on race differences in minimum wage effects in these data using a specification paralleling much of the existing literature. The estimates are consistent with minimum wages being more binding for black teenagers, with a larger positive point estimate on wages of blacks, and larger negative point estimates on employment and hours of blacks, although the differences are not statistically significant. Stronger contemporaneous effects for black teenagers make it more likely that exposure to a higher minimum wage in the early years in the labor market will have more adverse longer-run effects for blacks, although these stronger adverse longer-run effects could arise regardless of differences in contemporaneous effects, for reasons discussed below.

The next specifications in Table 8 explore whether blacks are more adversely affected in the longer run by exposure to minimum wages, especially during the earliest years in the labor market. In particular, Panel B of Table 8 reports estimates of the specification (equation (3)) that uses the weighted exposure measure that distinguishes by age of exposure. The evidence is consistent with more adverse longer-run effects of minimum wages for blacks. In most instances in which there is a statistically significant past exposure effect for at least one of the races, the estimated impact is larger for blacks. Furthermore, the evidence of adverse longer-run effects of minimum wages is more pervasive for blacks. For example, for 20-24 year-olds the effect on employment of exposure as a teen is larger in magnitude for blacks than for whites, and the effects on the rest of the outcomes are similar in magnitude, although not always statistically significant for blacks. But for blacks there are also negative and significant effects of exposure to a high minimum at ages 20-24 for employment, hours, and earnings.[30] Finally, the estimated effects of exposure as a teen for the 25-29 year-old sample are particularly large for blacks and always statistically significant, and there are also significant effects of exposure at older ages, although exposure as a teen always has the greatest negative impact.

A natural question is why there are such sharp differences between blacks and whites in the longer-run effects of exposure to a high minimum at young ages. The explanation presented thus far is simply that because minimum wages are more binding for blacks, their consequences should be more severe.[31] A potential additional factor, however, is racial differences in illegal activities and experiences with the criminal justice system (see, Grogger, 1998, for a discussion of research on race differences in participation in crime). Previous researchers have considered whether a higher minimum wage increases or reduces crime—especially property crimes or other crimes that provide illicit income—by teenagers and young adults. Theoretical predictions are ambiguous, as higher wages paid to some may deter crime, while reduced employment probabilities may increase it. Empirical evidence is also ambiguous.[32] If minimum wages do lead to increased criminal activity among youths, and even more so if the criminal justice system generates harsher consequences of criminal behavior for blacks, then this may help to explain the sharper effects for blacks of exposure to high minimum wages as teenagers, as incarceration can result in the destruction of human capital and criminal records can lead to subsequent labor market difficulties (e.g., Kling, et al., 2001), although at this point this explanation is speculative.

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[30] In results not shown, the contemporaneous specifications (paralleling Panel A) for 20-24 year-olds revealed rather large (but insignificant) negative employment and hours effects for blacks, but not for whites.

[31] Given stronger disemployment effects of minimum wages for blacks, the longer-run impact of minimum wages would be amplified if returns to experience were higher for blacks than for whites. However, the evidence suggests that the opposite is probably the case (e.g., Oettinger, 1996).

[32] Research on the economics of crime that tries to isolate the effect of exogenous variation in wages concludes that higher wages deter crime (e.g., Grogger, 1998). Research on the effects of the minimum wage, per se, is mixed. Time-series evidence in Hashimoto (1987) indicates that minimum wages increase property crimes but not violent crimes, while Chressanthis and Grimes (1990) suggest that the evidence is quite fragile. The specifications used by Chressanthis and Grimes are perhaps more suspect. For example, they include the school enrollment rate as a control variable despite the fact that it is an endogenous outcome when we are thinking about youth time allocation decisions in response to minimum wages. Nonetheless, the point remains that the conclusions are quite sensitive to model specification (see also Kallem, 2004).

Variation in the Effects of Exposure to High Minimum Wages Along Other Dimensions

The results by race are inherently interesting given the focus on race differences in the effects of minimum wages in the earlier literature focusing on contemporaneous effects, and given worse labor market outcomes for blacks. But the race differences are also of interest for a more general reason. Specifically, by identifying two groups that should be differentially affected by longer-run exposure to high minimum wages, and finding evidence of stronger effects on the group for whom this would be expected (in this case, blacks), the race results provide additional evidence that the longer-run effects of minimum wages identified by our approach are causal. Essentially, the race differences provide a third level of differencing, relative to the difference-in-differences identification strategy that relies solely on the variation in exposure across time and states.[33]

Schooling provides another observable dimension along which we can make predictions about how binding minimum wages are, although in this case the variation in the extent to which minimum wages are binding is more clearly due to skill than discrimination. To examine whether we similarly find stronger effects of exposure to minimum wages among the less skilled, Table 9 presents results disaggregated by whether or not one completed high school. To reduce the likelihood that an individual who later returns to school is incorrectly classified as a high school dropout, this analysis is presented only for those aged 25-29. The results are consistent with expectations, as the consequences of exposure to a minimum wage at young ages are more adverse for those who ultimately drop out of high school. For the latter, the estimated effects of exposure as a teen are negative and significant for all four outcomes (at the ten-percent level in two cases), with the effects stronger than for those who complete high school for employment, hours, and earnings. Of course these estimates are somewhat more problematic than those for race, because (as discussed earlier) education is potentially endogenous with respect to minimum wages. Nonetheless, given that those who do not complete high school most likely have lower

[33] Of course it is possible that economic conditions affect different groups differently, in which case this approach fails, as it hinges on the assumption that the unmeasured factors influencing the dependent variables *aside from* the minimum wage are similar across groups.

unobserved skills independently of this decision, the estimates are consistent with the least skilled suffering more adverse longer-run effects of minimum wages.

Are the Estimated Effects Spurious?

Our regression estimates have identified reductions in wages, earnings, and work among adults exposed to higher minimum wages as teenagers. Of course these estimates may not identify causal effects if there were other changes associated with exposure to higher minimum wages that actually underlie the changes in wages, earnings, and work. In this subsection, we take two approaches to asking whether the estimated effects of exposure to higher minimum wages when young are spurious.

First, we reverse the tables, in a sense, and look at groups for which we should not find minimum wage effects if the relationships documented thus far are causal, but for which, conversely, evidence of such minimum wage effects would suggest that the relationships are spurious. Specifically, in this analysis we study 40-44 and 45-49 year-olds instead of 20-24 and 25-29 year-olds. We retain the minimum wage histories of the younger groups, but substitute the labor market outcomes of the older groups for those of the younger groups, by single-year age categories within state-year cells (matching 40 year-olds to 20 year-olds, etc.). This exercise addresses the alternative hypothesis (as opposed to a true causal effect of exposure to a higher minimum wage when young) that minimum wage histories are for some reason correlated with contemporaneous economic conditions so as to generate spurious relationships between these minimum wage histories and labor market outcomes for 20-24 or 25-29 year-olds. If the estimated relationships for 20-24 or 25-29 year-olds are spurious, then we should find similar relationships when we substitute labor market outcomes of the older groups for those of the younger groups.[34]

The results are reported in Table 10. Compared with the corresponding estimates in Table 6, the results show that for the most part the labor market outcomes of 40-49 year-olds are not negatively related

[34] The approach we pursue here is equivalent to asking whether the wages, etc., of 40-49 year-olds are affected by the minimum wages to which they were exposed beginning at age 36 (paralleling studying the effects of exposure beginning at age 16 for 20-29 year-olds). Again, if we think longer-run effects of minimum wages arise at young ages when minimum wages were likely to be binding, we would not expect to find such effects.

to the exposure of younger cohorts to high minimum wages. The only exception is the results for employment and hours for 40-44 year-olds, where the estimates are about half as large as those for 20-24 year-olds. This latter finding suggests that some of the evidence of adverse effects on employment and hours from exposure to a high minimum wage as a teen may be spurious. This may not be entirely surprising, since, as noted earlier, it is not immediately obvious why that past exposure should affect contemporaneous labor supply.[35] But the most important finding is that for wages and earnings—for which the prediction of longer-run effects of minimum wages is perhaps most natural and compelling—there is no evidence of any relationship with the exposure variables for either 40-44 or 45-49 year-olds. This evidence bolsters a causal interpretation of the negative relationships we have found between exposure to a high minimum wage as a teen and later wages and earnings.

Second, the only "history" for which we have controlled thus far is the minimum wage history. But this minimum wage history may be correlated with the history of other variables that affect subsequent labor market outcomes, including most importantly, perhaps, economic conditions.[36] We therefore augment the specifications from Table 6 with controls for exposure to unemployment rates in each of the three age ranges we study, including the average unemployment rate exposed to at ages 16-19, 20-24, and 25-29. The results are reported in Table 11.[37]

The estimates indicate that the history of unemployment rates to which individuals were exposed does in fact impact contemporaneous outcomes, with numerous cases where higher unemployment rates—including past rates—have negative effects on current wages, employment, hours, and earnings. Moreover, the estimated minimum wage effects moderate as a result of the inclusion of the unemployment history. For 20-24 and 25-29 year-olds the wage and earnings effects of exposure to a

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[35] On the other hand, for the other two approaches to this question—using differences by race and education—we found evidence consistent with negative longer-run effects on employment and hours. Thus, on balance, we think the evidence also points toward adverse longer-run effects on employment and hours, while we acknowledge that this evidence is more ambiguous than that for wages and earnings.

[36] For example, we have already discussed the work by Mroz and Savage (2003) on the longer-term effects of earlier spells of unemployment. See also Beaudry and DiNardo (1991).

[37] Note that the sample is a bit smaller here because prior to 1979 smaller states were not separately identified in the CPS and therefore unemployment rates by state are not always available for the earlier cohorts at young ages.

minimum wage as a teenager fall by about half, but because the standard errors of the estimates also fall these estimated effects remain statistically significant. The employment and hours effects become smaller and insignificant. The reduction in the estimated wage and earnings effects may in some sense be reassuring, as the main estimates of these effects discussed previously were fairly large. At the same time, the bottom line is that the negative effects on adult wages and earnings of earlier exposure to high minimum wages persist in this alternative specification.

Finally, there is a potential endogeneity problem because the dependent variables may be determined jointly with at least the more recent unemployment rates. But these unemployment rates are calculated for all ages to pick up general economic conditions, and should not be much influenced by changes in employment, hours, etc., for a narrow age group. Moreover, the results were quite similar if the most contemporaneous unemployment rate variable was omitted (which can be done for the 20-24 and 25-29 year-olds), which ought to reduce any endogeneity bias. A second potential problem is that if the higher minimum wage in earlier years contributed to the higher unemployment rate at the same time, then this specification may over-control for the minimum wage and hence understate its effect, although we suspect that the contribution of minimum wages to aggregate employment is negligible. Because of these potential problems with the specification including past unemployment rates, we have chosen to emphasize throughout much of the paper the estimates excluding these rates, although we suspect that the actual effects of exposure to earlier minimum wages likely lie somewhere between the effects reported in Table 6 and those reported here in Table 11.

The Minimum Wage "History" and Migration

Finally, we return to the potential mismeasurement of the minimum wage "history" faced by workers, given that this history is based on state of residence at the time they are observed. The implication of such measurement error is that as we look further back in time from the CPS observation on each individual, the minimum wage history is likely to be more error-ridden, and the estimated effects of exposure more biased toward zero. Thus, the evidence indicating that the strongest negative effects of minimum wages stem from exposure in the teen years seems unlikely to be attributable to this measurement error, and we might expect the evidence of longer-run negative effects of exposure to high minimum wages as a teenager to be, if anything, stronger in the absence of this measurement problem, although the effect may be slight.

Another possible source of bias pertaining to the minimum wage "history" is the endogenous choice of the current state of residence. Insofar as this choice is related to minimum wages, we would expect that individuals move so as to offset adverse effects of minimum wages or to take advantage of beneficial effects; that is, migration should arbitrage away some of the costs or benefits of higher minimum wages. Thus, for example, less-skilled individuals who are teenagers in states with high minimum wages might be more likely to move to lower minimum wage states to try to offset whatever adverse effects on skill formation, etc., may have been generated by exposure to a high minimum wage as a teenager. A migration pattern like this would tend to understate negative effects of exposure to a higher minimum wage, given how we measure this exposure; another way to think about this is simply that endogenous migration generates a positive correlation between skill and minimum wages. Again, then, this source of bias seems unlikely to account for our findings.[38]

To address this issue more directly, we turned to data from the 1990 and 2000 Census of Population PUMS files, which include information on some measures related to skill or wages, age, and mobility between states. We looked at those aged 20-24 in 1990 or 2000 and who were teenagers five years earlier, and identified those who had changed states of residence since five years ago; the share of such movers is about 13 percent for 20-24 year-olds.[39] We then matched these records to the minimum

[38] Another type of migration that may be relevant is illegal immigration into a state. This may be somewhat more likely to occur when minimum wages are high, because the high minimum makes such employees—for whom minimum wage laws may be more likely to be violated—more attractive to employers. If so, then the increased supply of unskilled workers in response to a high minimum wage may lead to worse labor market outcomes for legal workers, who may be more likely to be surveyed. However, this does not undermine the results reported thus far. It simply outlines one of the responses to a higher minimum wage that may exacerbate the contemporaneous, and hence also the longer-run, effects of the minimum wage. Illegal immigrants are simply another input toward which employers may substitute in response to a higher minimum wage.

[39] In-state moves are also identified, although these are not relevant to our inquiry. We excluded those who lived abroad five years earlier. The non-movers are also potentially of interest, since that in itself may be viewed as a migration decision. However, we suspect that for many individuals staying in the same state is largely exogenous, and therefore want to avoid the relationship between wage- or skill-related measures and changes in the minimum wage gap that arise simply because of changes in the minimum wage in the state in which one resides.

wage gaps by state and year used throughout this paper, and estimated a regression model for the change in the minimum wage gap associated with inter-state migration as a function of race, sex, ethnicity, and an indicator for education less than a high school degree. This tells us whether, among those who move between states, those with less skills or lower wages (whether because of skill or discrimination) exhibit a tendency to move to states with higher or lower minimum wages.

The estimates are reported in Table 12. With respect to education, sex (in the 1990 data), and race, characteristics associated with lower wages and skills are also associated with moves to states with lower minimum wage gaps. For these three characteristics, then, the evidence is consistent with the conjecture that lower-wage or lower-skill workers, when they move, migrate to states with lower minimum wages, which would if anything bias our earlier estimates against finding adverse effects of exposure to a high minimum wage as a teenager. The results for Hispanics, however, go the other way, as the estimated effect on the change in the minimum wage gap associated with a move is positive.[40] On balance, there is no reason to infer from these estimates that endogenous migration leads to overly strong adverse impacts of exposure to high minimum wages at young ages; across the different skill- or wage-related measures, the positive and negative effects on changes in the minimum wage gap associated with migration are roughly offsetting.

V. Conclusions

We study whether exposure to minimum wages at young ages leads to longer-run effects on labor market outcomes. Adverse longer-run effects could arise because of decreased labor market experience and accumulation of tenure, lower current labor supply, diminished training and skill formation (including schooling), and other influences, although there are also possible channels of positive longer-run effects. If minimum wages have longer-run negative effects, then an exclusive focus on short-run effects of minimum wages on youths—which characterizes nearly all of the existing research and policy debate on

[40] Of course the underlying story for Hispanics is potentially more complex because of the possible continuation of migration patterns beginning with migration into the United States.

minimum wages[41]—fails to capture a potentially harmful effect of minimum wages and one that may be more important from a policy perspective, both because the effects are persistent and because they fall on older individuals who are likely to be primary breadwinners in their families.

We estimate the longer-run effects of minimum wages by using information on the minimum wage history that workers have faced since potentially entering the labor market at age 16. Given the data limitations, we have to do this based on current state of residence, which is not perfect; but we have argued that this does not appear to drive our results. We identify the effects from variation in state minimum wages above the federal minimum wage, in a flexible specification that sweeps out all common state-level influences and aggregate time-series influences on the outcomes we study.

The evidence indicates that even as individuals reach their late 20's, they earn less and may also work less the longer they were exposed to a higher minimum wage. In particular, exposure during one's teenage years imposes longer-run costs, presumably because minimum wages are most likely to be binding during those years. Furthermore, the adverse longer-run effects of facing high minimum wages as a teenager are stronger for blacks and for those who do not complete high school, again presumably reflecting the greater extent to which minimum wages are binding for these groups. Thus, we obtain a robust finding of negative longer-run effects of minimum wages, and the pattern of variation in these effects is consistent with expectations based on the degree to which minimum wages are binding. In our view, then, this research indicates that it is important to focus on more than simply the contemporaneous effects of minimum wages on the youngest individuals, as this narrow and short-run focus may lead us to miss minimum wage effects that are manifested in the longer run—effects that turn out to be quite unambiguously adverse.

Finally, the estimated longer-run effects of minimum wages can be only partially explained via the influences of minimum wages on labor supply and human capital—including lower current labor

[41] One exception is research on the effects of minimum wages on the family income distribution (for a recent example and references to the literature, see Neumark, et al., 2002). Here too, though, the focus is on short-run effects rather than, for example, whether minimum wages help or hurt families' ability to escape and stay out of poverty.

supply, foregone experience, and diminished training. Other influences may amplify the costs of early spells of non-employment stemming from exposure to high minimum wages as a youth. These may include negative signals conveyed to employers, failure to acquire behaviors valued in the workplace, the development of weaker labor market networks, criminal behavior and its implications, and attachment to peer groups that place less emphasis on labor market success. These alternative explanations are speculative, but additional research on the longer-run effects of minimum wages should focus on understanding the sources of these effects.

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Table 1: Ages, Years, and Cohorts Used in Analysis

		Cohort:																												
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Year:	1979	22	21	20	19	18	17	16																						
	1980	23	22	21	20	19	18	17	16																					
	1981	24	23	22	21	20	19	18	17	16																				
	1982	25	24	23	22	21	20	19	18	17	16																			
	1983	26	25	24	23	22	21	20	19	18	17	16																		
	1984	27	26	25	24	23	22	21	20	19	18	17	16																	
	1985	28	27	26	25	24	23	22	21	20	19	18	17	16																
	1986	29	28	27	26	25	24	23	22	21	20	19	18	17	16															
	1987		29	28	27	26	25	24	23	22	21	20	19	18	17	16														
	1988			29	28	27	26	25	24	23	22	21	20	19	18	17	16													
	1989				29	28	27	26	25	24	23	22	21	20	19	18	17	16												
	1990					29	28	27	26	25	24	23	22	21	20	19	18	17	16											
	1991						29	28	27	26	25	24	23	22	21	20	19	18	17	16										
	1992							29	28	27	26	25	24	23	22	21	20	19	18	17	16									
	1993								29	28	27	26	25	24	23	22	21	20	19	18	17	16								
	1994									29	28	27	26	25	24	23	22	21	20	19	18	17	16							
	1995										29	28	27	26	25	24	23	22	21	20	19	18	17	16						
	1996											29	28	27	26	25	24	23	22	21	20	19	18	17	16					
	1997												29	28	27	26	25	24	23	22	21	20	19	18	17	16				
	1998													29	28	27	26	25	24	23	22	21	20	19	18	17	16			
	1999														29	28	27	26	25	24	23	22	21	20	19	18	17	16		
	2000															29	28	27	26	25	24	23	22	21	20	19	18	17	16	
	2001																29	28	27	26	25	24	23	22	21	20	19	18	17	16

Minimum wage data are used beginning as 1973, but monthly CPS ORG files are available beginning only in 1979. The analysis focuses on minimum wages from age 16 up to the present age (through age 29). Consequently, the youngest cohort we can study for 1979 is the cohort that was age 16 in 1973.

Table 2: Minimum Wages in Analysis Period

	Year:																												
	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01
Federal	1.60	2.00	2.10	2.30	2.30	2.65	2.90	3.10	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.35	3.80	4.25	4.25	4.25	4.25	4.25	4.25	4.75	5.15	5.15	5.15	5.15
Alaska	2.10	2.50	2.60	2.80	2.80	3.15	3.40	3.60	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85	4.30	4.75	4.75	4.75	4.75	4.75	4.75	5.25	5.65	5.65	5.65	5.65
California					2.50												4.25	4.25							5.00	5.75	5.75	5.75	6.25
Connecticut	1.85	2.01	2.11	2.31	2.31	2.66	2.91	3.12	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.75	4.25	4.25	4.27	4.27	4.27	4.27	4.27	4.27	4.77	5.18	5.65	6.15	6.40
Delaware																								4.65	5.00		5.65	5.65	6.15
DC	2.16	2.19	2.45	2.55	2.76	2.79	2.95	3.14	3.48	3.62	3.82	3.82	3.85	3.86	4.16	4.33	4.33	4.38	4.51	4.55	4.55	5.25	5.25	5.25	5.75	6.15	6.15	6.15	6.15
Hawaii				2.40	2.40											3.85	3.85	3.85		4.75	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
Idaho																													
Iowa																		3.85		4.65	4.65	4.65	4.65	4.65					
Maine	1.80	1.80											3.45	3.55	3.65	3.65	3.75	3.85											
Massachusetts	1.85														3.55	3.65	3.75							4.75	5.25	5.25	5.25	6.00	6.75
Minnesota																3.55	3.85	3.95											
New Hampshire															3.45	3.55	3.65												
New Jersey	1.75		2.20		2.50															5.05	5.05	5.05	5.05	5.05	5.05				
New York	1.85																												
Oregon																		4.25	4.75	4.75	4.75	4.75	4.75	4.75	5.50	6.00	6.50	6.50	6.50
Pennsylvania																	3.70												
Rhode Island															3.55	3.65	4.00	4.25	4.45	4.45	4.45	4.45	4.45	4.45	5.15			5.65	6.15
Vermont															3.45	3.55	3.65	3.85					4.50	4.75	5.00	5.25	5.25	5.75	5.75
Washington																	3.85	4.25				4.90	4.90	4.90	4.90		5.70	6.50	6.72

Table only displays states that ever have a minimum wage higher than the federal minimum in the 1973-2001 period. We do not consider a state as having a higher than federal minimum wage if coverage does not apply to men; in 1973 California had a minimum wage above the federal level ($1.65) for women only. Federal and state minimum wages for the year are reported as of May of that year. The DC minimum wage is a weighted average of occupation-specific minimum wages, for the earlier part of the sample.

Table 3: Examples of Construction of Unweighted Exposure Variable

		Year:													
		79-88	89	90	91	92	93	94	95	96	97	98	99	00	01
Oregon	Minimum wage	--	--	4.25	4.75	4.75	4.75	4.75	4.75	4.75	5.50	6.00	6.50	6.50	6.50
	Age: years of exposure	16-29:0	16-29:0	16-29:1	16:1 17-29:2	16:1 17:2 18-29:3	16:1 17:2 18:3 19-29:4	16:1 17:2 18:3 19:4 20-29:5	16:1 17:2 18:3 19:4 20:5 21-29:6	16:1 17:2 18:3 19:4 20:5 21:6 22-29:7	16:1 17:2 18:3 19:4 20:5 21:6 22:7 23-29:8	16:1 17:2 18:3 19:4 20:5 21:6 22:7 23:8 24-29:9	16:1 17:2 18:3 19:4 20:5 21:6 22:7 23:8 24:9 25-29:10	16:1 17:2 18:3 19:4 20:5 21:6 22:7 23:8 24:9 25:10 26-29:11	16:1 17:2 18:3 19:4 20:5 21:6 22:7 23:8 24:9 25:10 26:11 27-29:12
Pennsylvania	Minimum wage	--	3.70	--	--	--	--	--	--	--	--	--	--	--	--
	Age: years of exposure	16-29:0	16-29:1	16:0 17-29:1	16-17:0 18-29:1	16-18:0 19-29:1	16-19:0 20-29:1	16-20:0 21-29:1	16-21:0 22-29:1	16-22:0 23-29:1	16-23:0 24-29:1	16-24:0 25-29:1	16-25:0 26-29:1	16-26:0 27-29:1	16-27:0 28-29:1
Washington	Minimum wage	--	3.85	4.25	--	--	--	4.90	4.90	4.90	4.90	--	5.70	6.50	6.72
	Age: years of exposure	16-29:0	16-29:1	16:1 17-29:2	16:0 17:1 18-29:2	16-17:0 18:1 19-29:2	16-18:0 19:1 20-29:2	16-19:1 20:2 21-29:3	16:1 17-20:2 21:3 22-29:4	16:1 17:2 18-21:3 22:4 23-29:5	16:1 17:2 18:3 19-22:4 23:5 24-29:6	16:0 17:1 18:2 19:3 20-23:4 24:5 25-29:6	16:1 17:1 18:2 19:3 20:4 21-24:5 25:6 26-29:7	16:1 17:2 18:2 19:3 20:4 21:5 22-25:6 26:7 27-29:8	16:1 17:2 18:3 19:3 20:4 21:5 22:6 23-26:7 27:8 28-29:9

Table 4: Summary Statistics

	16-19 year-olds			20-24 year-olds			25-29 year-olds		
	Whole sample	State min. wage > federal	Federal min. wage prevails	Whole sample	State min. wage > federal	Federal min. wage prevails	Whole sample	State min. wage > federal	Federal min. wage prevails
Observations	4692	692	4000	5712	856	4856	4590	789	3801
Exposure, mean number of years	0.35 (0.90)	2.21 (1.08)	0.03 (0.25)	0.92 (2.10)	5.09 (2.37)	0.19 (0.77)	1.56 (3.29)	7.31 (4.16)	0.37 (1.21)
Exposure, weighted by state minimum wage gap, mean	0.038 (0.117)	0.243 (0.199)	0.003 (0.024)	0.098 (0.262)	0.557 (0.423)	0.017 (0.077)	0.166 (0.411)	0.806 (0.651)	0.033 (0.117)
State minimum wage gap, mean	0.017 (0.049)	0.112 (0.076)		0.017 (0.050)	0.113 (0.076)		0.020 (0.054)	0.116 (0.076)	
Employment, mean %	46.45 (14.59)	44.96 (15.52)	46.70 (14.41)	70.43 (8.91)	69.68 (10.42)	70.56 (8.62)	78.84 (6.50)	79.04 (6.82)	78.80 (6.43)
Mean real wage, $2001 dollars	6.54 (0.96)	7.10 (1.16)	6.44 (0.88)	9.15 (1.49)	9.96 (1.74)	9.00 (1.40)	12.34 (1.79)	13.72 (1.91)	12.06 (1.62)
Mean weekly hours of work, unconditional	11.88 (5.78)	11.20 (5.69)	11.99 (5.78	25.72 (4.47)	25.31 (5.05)	25.80 (4.36)	31.68 (3.14)	31.61 (3.27)	31.69 (3.11)
Mean weekly earnings, $2001, unconditional	85.43 (49.34)	86.87 (52.47)	85.18 (48.79)	247.63 (70.02)	265.22 (80.37)	244.53 (67.57)	404.65 (74.09)	448.62 (79.91)	395.53 (69.43)
Mean percentage at or below minimum wage	12.71 (6.79)	10.57 (6.41)	13.08 (6.78)	7.14 (4.47)	6.46 (4.34)	7.26 (4.49)	3.32 (2.58)	3.23 (2.72)	3.34 (2.55)

The "state minimum wage gap" equals the ratio of the state minimum wage to the federal minimum minus one. (It equals zero when there is no state minimum wage or if the state minimum is below the federal.) Each observation is the mean for the cells defined by state, year, and age (by single year), using the monthly CPS ORG files from 1979-2001. Standard deviations of these means are reported in parentheses. In computing mean weekly earnings, observations on individuals employed and reporting a wage were weighted by P(employed)/P(employed and wage reported). Without this weighting, mean earnings would be biased toward zero because data on wages are missing for the employed but not the non-employed. Real wages and earnings are based on the Consumer Price Index research series using current methods (CPI-U-RS); see http://www.bls.gov/cpi/cpiurstx.htm. Individual observations are weighted using CPS earnings weights.

Table 5: Estimated Effects of State Minimum Wage Gap, and Years of Exposure to Higher State Minimum Weighted by State Minimum Wage Gap

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)	Log(wage)	Percent employed	Hours	Log (weekly earnings)
16-19								
State minimum wage gap	0.2024** (0.0566)	-8.3337** (2.7978)	-1.9624* (0.7994)	-0.0455 (0.0917)				
Weighted exposure					0.0626* (0.0301)	-1.9574 (2.3917)	-1.1050+ (0.5699)	0.0790 (0.0617)
R^2	0.78	0.86	0.91	0.91	0.78	0.86	0.91	0.91
20-24								
State minimum wage gap	0.0123 (0.0751)	-2.1505 (3.8143)	-0.4169 (1.6499)	0.0166 (0.0875)				
Weighted exposure					-0.0159 (0.0236)	-2.6749 (1.8399)	-1.2747 (0.7945)	-0.0592 (0.0400)
R^2	0.80	0.64	0.74	0.82	0.80	0.64	0.74	0.82
25-29								
State minimum wage gap	-0.0013 (0.0393)	2.1578 (1.5305)	0.9913 (0.7601)	0.0286 (0.0443)				
Weighted exposure					-0.0381+ (0.0217)	-1.3336 (1.1336)	-0.6880 (0.5993)	-0.0607+ (0.0343)
R^2	0.77	0.48	0.52	0.71	0.77	0.48	0.53	0.71

All estimates are from linear regressions with standard errors reported in parentheses. More details on the variables are given in Table 4.
Standard errors are "clustered" by state, and hence are robust to arbitrary heteroscedasticity across states and arbitrary correlations across observations within states. A plus sign (+) indicates that estimate is statistically significant at the 10-percent level, a single asterisk (*) indicates that estimate is statistically significant at the five-percent level, and a double asterisk (**) indicates significance at the one-percent level. All regressions contain controls for age (single-year age dummy variables), year, and state. State-age-year observations are weighted by the number of observations in the cell, multiplied by the average CPS earnings weight of individuals in the state-year-age cell to correct for oversampling of individuals in small states.

Table 6: Estimated Effects of Years of Exposure to Higher State Minimum Weighted by State Minimum Wage Gap, by Age of Exposure

	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)
20-24				
Weighted exposure, 16-19	-0.0362* (0.0173)	-3.9269+ (2.1062)	-2.2174* (0.8678)	-0.1269** (0.0405)
Weighted exposure, 20-24	0.0022 (0.0322)	-1.5181 (1.9364)	-0.4036 (0.8183)	0.0033 (0.0489)
R^2	0.80	0.64	0.74	0.82
25-29				
Weighted exposure, 16-19	-0.1239** (0.0313)	-1.9492 (1.2586)	-1.3923+ (0.8227)	-0.1697** (0.0500)
Weighted exposure, 20-24	-0.0582 (0.0357)	-2.0081 (1.6134)	-1.2017 (0.8264)	-0.0991+ (0.0574)
Weighted exposure, 25-29	0.0255+ (0.0146)	-0.3432 (1.0629)	0.1861 (0.4900)	0.0335 (0.0232)
R^2	0.78	0.48	0.53	0.71

See notes to Table 5.

Table 7: Summary Statistics for Whites and Blacks

	16-19 year-olds		20-24 year-olds		25-29 year-olds	
	Whites	**Blacks**	**Whites**	**Blacks**	**Whites**	**Blacks**
Observations	4691	3897	5712	4768	4590	3845
Exposure, mean number of years	0.35 (0.90)	0.31 (0.84)	0.92 (2.10)	0.71 (1.89)	1.56 (3.32)	1.22 (3.11)
Exposure, weighted by state minimum wage gap, mean	0.038 (0.116)	0.034 (0.110)	0.098 (0.262)	0.079 (0.241)	0.166 (0.411)	0.138 (0.393)
State minimum wage gap, mean	0.017 (0.049)	0.016 (0.050)	0.017 (0.050)	0.017 (0.051)	0.020 (0.054)	0.020 (0.055)
Employment, mean %	49.85 (14.63)	29.05 (25.38)	73.02 (8.85)	56.43 (26.93)	80.58 (6.81)	68.87 (24.51)
Mean real wage, $2001 dollars	6.56 (0.99)	6.48 (1.99)	9.26 (1.57)	8.50 (2.75)	12.62 (1.96)	10.76 (3.08)
Observations, wages	4677	3211	5712	4374	4590	3620
Mean weekly hours of work, unconditional	12.81 (6.04)	8.91 (7.79)	26.80 (4.56)	21.84 (9.51)	32.58 (3.39)	28.36 (8.89)
Observations, hours	4677	3208	5712	4370	4590	3612
Mean weekly earnings, $2001, unconditional	92.17 (52.11)	62.92 (69.01)	260.90 (74.18)	194.26 (112.73)	425.72 (86.45)	314.31 (142.31)
Observations, earnings	4677	3208	5712	4370	4590	3612
Mean percentage at or below minimum wage	13.44 (7.69)	8.88 (14.86)	7.12 (4.82)	7.29 (14.34)	3.18 (2.65)	3.84 (10.59)

See notes to Table 4 for details. Samples are sometimes smaller because of absence of white or black respondents in a cell.

Table 8: Estimated Effects of State Minimum Wage Gap, and Years of Exposure to Higher State Minimum Weighted by State Minimum Wage Gap, by Age of Exposure, and by Race

	White				Black			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)	Log(wage)	Percent employed	Hours	Log (weekly earnings)
A. Contemporaneous specification:								
16-19								
State minimum wage gap	0.1892** (0.0578)	-8.7416** (2.8724)	-1.6223+ (0.8679)	-0.0039 (0.0871)	0.2699** (0.0841)	-9.6783+ (5.0850)	-2.4826 (1.8501)	0.0386 (0.5975)
R^2	0.77	0.83	0.91	0.90	0.40	0.51	0.61	0.62
B. Exposure specifications:								
20-24								
Weighted exposure, 16-19	-0.0397+ (0.0209)	-4.1484+ (2.0801)	-2.3199* (0.9038)	-0.1358** (0.0435)	-0.0354 (0.0220)	-5.9336* (2.7527)	-2.2890* (1.0271)	-0.1299 (0.0908)
Weighted exposure, 20-24	-0.0015 (0.0383)	-0.1400 (1.8966)	0.1260 (0.7555)	0.0206 (0.0511)	-0.0589 (0.0529)	-5.9707* (2.8620)	-3.0113* (1.2621)	-0.1928+ (0.1026)
R^2	0.79	0.56	0.70	0.80	0.47	0.40	0.49	0.51
25-29								
Weighted exposure, 16-19	-0.1355** (0.0381)	0.9531 (1.4888)	-0.0765 (0.9146)	-0.1397* (0.0590)	-0.2329** (0.0508)	-11.1465** (2.2789)	-6.1023** (1.4451)	-0.4737** (0.1042)
Weighted exposure, 20-24	-0.0681 (0.0413)	-1.6161 (1.8034)	-1.0923 (0.9095)	-0.1051 (0.0653)	-0.1033+ (0.0524)	-1.0173 (1.9771)	-0.2431 (0.9311)	-0.0973+ (0.0562)
Weighted exposure, 25-29	0.0074 (0.0183)	0.4541 (1.0151)	0.6511 (0.4565)	0.0284 (0.0242)	-0.0031 (0.0288)	-6.9412** (2.2250)	-3.0677** (1.0660)	-0.1221** (0.0421)
R^2	0.74	0.46	0.50	0.68	0.47	0.30	0.35	0.37

Specification in Panel A corresponds to columns (1)-(4) of Table 5. Specifications in Panel B correspond to Table 6. See notes to Table 5 and 7.

Table 9: Estimated Effects of State Minimum Wage Gap, and Years of Exposure to Higher State Minimum Weighted by State Minimum Wage Gap, by Age of Exposure, for High School Dropouts and High School Graduates

	High School Graduates				**High School Dropouts**			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)	Log(wage)	Percent employed	Hours	Log (weekly earnings)
25-29								
Weighted exposure, 16-19	-0.1266** (0.0283)	-1.2872 (1.2308)	-1.1363 (0.8688)	-0.1614** (0.0468)	-0.1117* (0.0421)	-5.2711+ (2.7225)	-2.5283+ (1.3518)	-0.2537** (0.0758)
Weighted exposure, 20-24	-0.0474 (0.0296)	-1.6483 (1.3512)	-1.1517 (0.7192)	-0.0834+ (0.0461)	-0.1170* (0.0438)	1.1851 (2.8210)	1.1865 (1.1996)	-0.0578 (0.0706)
Weighted exposure, 25-29	0.0283* (0.0140)	-0.5899 (1.0939)	0.0958 (0.5073)	0.0325 (0.0223)	-0.0172 (0.0393)	1.6359 (3.2383)	0.8177 (1.2275)	0.0249 (0.0423)
R^2	0.78	0.41	0.48	0.71	0.21	0.23	0.23	0.18
Observations	4590	4590	4590	4590	4377	4545	4374	4365

Specifications correspond to those in Table 6. See notes to Table 5. High school dropouts are defined as those who have less than high school education; for 1979-1991 this is based on years of schooling, and for 1992-2001 on whether a high school diploma (or equivalent) was earned (Jaeger, 1997). (Before 1997, it was not possible in the CPS to distinguish high school graduates from those with a GED; see Clark and Jaeger, 2002.)

Table 10: Estimated "Effects" on 40-49 Year-Olds of Years of Exposure of 20-29 Year-Olds as Teenagers to Higher State Minimum Weighted by State Minimum Wage Gap

	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)
40-44				
Weighted exposure of 20-24 year-olds at ages 16-19	0.0260+ (0.0153)	-2.7606* (1.1953)	-1.0464+ (0.5610)	0.0006 (0.0218)
R^2	0.68	0.45	0.49	0.62
Observations	5712	5712	5712	5712
45-49				
Weighted exposure of 25-29 year-olds at ages 16-19	0.0012 (0.0278)	-0.2788 (0.9535)	-0.4596 (0.6394)	-0.0192 (0.0306)
R^2	0.67	0.45	0.49	0.65
Observations	4590	4590	4590	4590

Specifications correspond to those in Table 6. See notes to Table 5. The estimates are computed using dependent variables defined for 40-44 and 45-49 year-olds matched to the minimum wage histories of the 20-24 and 25-29 year-olds in the same state-year cell. The matching is done year by year (40 year-olds matched to 20 year-olds, etc.)

Table 11: Estimated Effects of Years of Exposure to Higher State Minimum Weighted by State Minimum Wage Gap, by Age of Exposure, Including Unemployment Rate Exposure Controls

	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)
16-19				
Weighted exposure, 16-19	0.0620+ (0.0310)	-2.0009 (1.7091)	-1.2444** (0.3603)	0.0403 (0.0313)
Average UR, 16-19	-0.0164** (0.0024)	-1.6824** (0.1396)	-0.5890** (0.0525)	-0.0702** (0.0061)
R^2	0.80	0.87	0.91	0.92
Observations	4692	4692	4692	4692
20-24				
Weighted exposure, 16-19	-0.0247 (0.0234)	-0.2952 (1.9501)	-0.5078 (0.6817)	-0.0504+ (0.0259)
Weighted exposure, 20-24	-0.0110 (0.0253)	-1.6015 (1.8673)	-0.4747 (0.7262)	-0.0113 (0.0391)
Average UR, 16-19	-0.0177** (0.0024)	0.0228 (0.0842)	-0.0396 (0.0333)	-0.0203** (0.0028)
Average UR, 20-24	-0.0131** (0.0032)	-1.2965** (0.0846)	-0.6262** (0.0400)	-0.0382** (0.0035)
R^2	0.84	0.67	0.77	0.85
Observations	5448	5448	5448	5448
25-29				
Weighted exposure, 16-19	-0.0659* (0.0255)	1.1464 (1.1717)	0.1699 (0.5523)	-0.0686* (0.0294)
Weighted exposure, 20-24	-0.0608+ (0.0333)	1.2895* (0.6413)	0.5044 (0.3307)	-0.0537 (0.0403)
Weighted exposure, 25-29	0.0113 (0.0118)	-0.6020 (0.9737)	0.0908 (0.5093)	0.0143 (0.0173)
Average UR, 16-19	-0.0047** (0.0015)	-0.1186 (0.0869)	-0.0298 (0.0370)	-0.0063** (0.0021)
Average UR, 20-24	-0.0143** (0.0025)	-0.3661** (0.0660)	-0.1676** (0.0366)	-0.0193** (0.0033)
Average UR, 25-29	-0.0061+ (0.0032)	-1.0252** (0.0862)	-0.5195** (0.0442)	-0.0216** (0.0037)
R^2	0.80	0.51	0.56	0.75
Observations	4260	4260	4260	4260

See notes to Table 5.

Table 12: Relationship Between Wage- and Skill-Related Variables and Change in Minimum Wage Gap for Movers, 20-24 Year-Olds

	Change in minimum wage gap	
	1990 PUMS	2000 PUMS
	(1)	(2)
Education less than high school	-0.0035** (0.0005)	-0.0024** (0.0008)
Female	-0.0008** (0.0003)	0.0007 (0.0005)
Non-white	0.0004 (0.0005)	-0.0050** (0.0006)
Hispanic	0.0096** (0.0006)	0.0052** (0.0009)
Observations	100454	98560
Share of movers in age group	0.128	0.130
R^2	0.0026	0.0008

Sample used in estimation excludes individuals who lived abroad 5 years ago. A single asterisk (*) indicates that estimate is statistically significant at the five-percent level, and a double asterisk (**) indicates significance at the one-percent level. The five-percent PUMS samples are used.