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ABSTRACT

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 work less and earn 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.

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I. Introduction

Exposure to a high minimum wage during the years in which teens and young adults 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. Existing research suggests that minimum wages may lower training among young workers, reduce the accumulation of labor market skills and experience by deterring their employment, and discourage school enrollment, although these conclusions are not without controversy.[1] This paper does not revisit these controversies, although it reports new evidence on some of them. But if, in fact, minimum wages reduce training, employment, and schooling of young individuals, then we should expect more lasting adverse effects on both wages, employment, and other labor market outcomes. Furthermore, these longer-run 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. On the other hand, longer-run effects that counter some of the potential 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 initial wage increases stemming from minimum wages could have persistent effects.

[1] The employment effects literature is well known and extensive. See Burkhauser, et al. (2000) for a recent study in the lengthy literature presenting evidence of disemployment effects for young individuals, but Card and Krueger (1995) for the contrary view. 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,

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 minimum wages, because, for example, teens or young adults 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 (or 20-24 year-olds) are affected by contemporaneous minimum wages, we estimate the effects of exposure to higher minimum wages at these younger ages—when minimum wages were most binding—on outcomes for somewhat older individuals (25-29 year-olds).[4]

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),[5] 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 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

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predictions are ambiguous for a number of reasons, including that raising the wage floor for unskilled workers could reduce the return to education.

[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] We follow much of the minimum wage literature and define "youth" as ages 16-24.

[5] In our regressions, 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.

residence will measure the true minimum wage history with error.[6] 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.[7,8]

The specifications estimated below use three different measures of the minimum wage. The first is simply the current "effective" minimum wage in the state, defined as the log of the higher of the state minimum wage and the federal minimum wage. This parallels the typical study of contemporaneous, short-run effects of minimum wages in the existing literature. In the models we estimate we include fixed year and state effects, so the time-series variation induced by the federal minimum is swept out, and identification comes from variation in state minimum wages that are set above the federal level. The second measure captures not just the current effective minimum wage, but also the history of the minimum wage to which an individual has been exposed, by adding up and averaging the log of the effective minimum wage to which an individual in any cell defined by state, year, and age has been exposed in each year, from age 16 to the present age. Because we also condition on single-year age dummy variables, identification again comes from variation in state minimum wages set above the federal minimum. Finally, in what we regard as the most informative specifications, we distinguish between exposure at younger ages when minimum wages should have been more binding and exposure at older

[6] 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.

[7] 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.

[8] 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).

ages. Specifically, we compute the average effective log minimum wage to which an individual in a state-year-age cell was exposed in each of three periods: ages 16-19, ages 20-24, and ages 25-29.[9]

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 22 or younger in 1979. Table 1 arrays the ages and years that are 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.[10] 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.[11]

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

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[9] We compute this only up to the current age. For example, for a 17 year-old we would use the minimum wage faced at ages 16 and 17.

[10] 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.

[11] 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.

in some years having a minimum only a shade higher than the federal minimum,[12] and other states and years with minimums exceeding the federal minimum by well over a dollar.

Table 3 provides some examples as to how this information is used to construct the average effective minimum wage to which an individual in a particular state-year-age cell was exposed. Although we use logs of minimum wages in our empirical analysis, Table 3 presents calculations for levels, to make the links to Table 2 more clear. The example covers Oregon for 1989, 1990, and 1991; a higher minimum wage was first enacted in 1990. We first show some representative computations for the minimum wage exposure measure for all ages (i.e., not distinguishing the age at which the exposure occurred). In 1989, the federal minimum wage was binding, and had been—at $3.35—since 1981 (see Table 2). So for 16-24 year-olds the minimum wage measure is $3.35.[13] For 25 year-olds, the federal minimum was $3.35 for nine of the 10 years they were in the labor market (beginning at age 17), and $3.10 at age 16 (in 1980), so that average is shown. And for 29 year-olds, the average is computed over the 14 years beginning at age 16, and includes the earlier federal minimum wage from 1976-1979. In 1990 the higher state minimum wage of $4.25 takes effect, and each age group is exposed to this higher minimum for one year. For 16 year-olds the average effective state minimum wage is simply $4.25, for 17 year-olds the average of $4.25 and the federal minimum wage of $3.35 in the previous year, etc. Clearly this case will generate variation relative to a 16 year-old in a state in which the lower federal minimum wage prevails in 1990. The computation for 1991 follows the same logic. The last row provides examples of computing the minimum wage variable that distinguishes exposure by the age at which it occurred. For 20 year-olds in 1991, for example, the average effective minimum wage is the average computed over the federal minimum wage from 1987-1989 and the higher state minimum wage for 1990.

Table 4 reports descriptive statistics for the sample, 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

[12] 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.
[13] For clarity, examples in table are done for nominal minimum wages. In the empirical analysis, all wage and earnings measures are converted into 2001 dollars.

single-year age appears in Table 1, multiplied by 51 (for the 50 states and Washington, D.C.). 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 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.[14] Similarly, looking at earnings without conditioning on employment gives us a summary measure of the overall effects of minimum wages on workers' earnings.

The construction of wages, hours, and weekly earnings is sometimes 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 outcomes.[15] 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.

To provide some information on how the minimum wage variables vary, the descriptive statistics are broken down by whether or not the current state minimum wage exceeds the federal minimum. Not surprisingly, the average effective log state minimum wage since age 16 is higher in the group of observations in which the current state minimum exceeds the federal. For example, for teenagers the

[14] 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 fixed costs of employment. 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).

[15] 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).

average value for this group is 1.75 (corresponding to a minimum wage in 2001 dollars of $5.72), compared with 1.68 (corresponding to a minimum wage of $5.42) for the other observations. The difference is a bit smaller for the average effective state minimum wage, because states currently bound by the federal minimum sometimes had higher state minimums in the past.[16]

Looking at the outcomes, for 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 lower, but weekly earnings are higher, suggesting that the wage gains offset the employment and hours reductions. 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. Interestingly, though, the wage and earnings differences increase with age. Given that states with higher minimum wages in any period are more likely to have had high minimum wages in the past, this finding provides a hint that exposure to high minimum wages when young may adversely affect wages and earnings of 25-29 year-olds. However, these are only univariate comparisons that do not account for other factors controlled for in the regression estimates that follow.

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), a higher minimum is associated with a higher percentage at or below the

[16] The difference varies slightly across the age groups because of small differences in the years represented in each age group; see Table 1.

minimum (i.e., the within-state correlation is positive), which is the critical identifying information used in the empirical analysis.

III. Empirical Methods

We begin with simple specifications for the effects of the contemporaneous minimum wage on wages, employment, hours, and earnings, using specifications paralleling existing ones in the literature, 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 log of the effective contemporaneous minimum wage (the higher of the state or federal minimum). S, Y, and A are vectors of state, year, and single-year 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 characteristics that may be influenced 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 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.[17]

[17] 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

Observations within state-year cells for different single-year age groups may be non-independent, as, for example, state-level 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. This is not likely to be as severe a problem in our application, as there is less persistent variation in the minimum wage than in a dummy variable treatment that turns on and stays on for some states. Nonetheless, to flexibly allow for serial correlation as well as possible non-independence across age groups, we report standard errors that are robust to arbitrary correlation patterns among all observations for each state—i.e., across age or time—as well as arbitrary heteroscedasticity across states.[18]

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 current 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 contemporaneous minimum wage variable in equation (1) a measure of the average effective log minimum wage to which the individual was exposed, beginning at age 16,

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

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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.

[18] Allowing correlation across time also accounts for the non-independence stemming from overlapping samples in the CPS. We experimented with more restrictive versions, including clustering only on state and year—which allows for arbitrary correlations across different age groups in the same state and year—and clustering on state and age—which allows arbitrary correlations across time on the same age group in the same state, but not correlations across different age groups. For the estimates reported in the tables, standard errors using these alternatives were always smaller, and often substantially so.

where MWEXP measures this minimum wage exposure.[19] This equation, too, is estimated for the three different age groups. In this specification γ identifies the effect of exposure to high minimum wages.[20] The inclusion of year effects removes the influence of common movements in the exposure variable generated by variation in the federal minimum.

Finally, equation (2) is modified by dropping the restriction that exposure to a higher minimum wage has equal effects on the dependent variables regardless of the age at which the exposure 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

$$(3) \qquad Z_{ijt} = \alpha + \gamma_1 MWEXP^{1619}{}_{ijt} + \gamma_2 MWEXP^{2024}{}_{ijt} + \gamma_3 MWEXP^{2529}{}_{ijt} + S_i\theta_S + Y_t\theta_Y + A_j\theta_A + \varepsilon_{ijt} \ .$$

The three variables $MWEXP^{1619}$, $MWEXP^{2024}$, and $MWEXP^{2529}$ measure exposure to a higher minimum during the specified age ranges. When this specification is estimated for 20-24 year-olds, EXP^{2529} is of course dropped. For 16-19 year-olds we would also drop EXP^{2024}, 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 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

[19] 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.

[20] 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.

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, 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).[21] 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

Estimated effects of contemporaneous minimum wages, based on equation (1), are reported in Table 5. The estimates in the first column are consistent with a positive and significant effect of minimum wages on wages of teenagers. Given that the log minimum wage gap between states with and without a higher minimum is 0.07, multiplying the estimated minimum wage coefficient by 0.07 yields the effect of an "average" higher state minimum wage. The estimated coefficient of 0.2216 therefore implies that imposing the average state minimum wage results in wages for teenagers that are higher by about 1.6 percent (0.222·0.07). Of course for this double-log specification the estimated elasticity is the coefficient estimate. Existing research has reported elasticities of wages near the minimum with respect

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

to minimum wages and found higher values,[22] but the 0.22 figure is an average across all teens—many of whom earn above the minimum wage. No doubt reflecting in part 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 smaller, near zero, and statistically insignificant.

Column (2) reports estimates for employment. There is evidence of a significant negative employment effect for teenagers. With an estimated coefficient of −9.40, the implied elasticity is −0.20.[23] 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 −0.19).

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 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 estimates in Table 5 point to contemporaneous effects of minimum wages only on employment and hours of teenagers. This does not imply that there are not other adverse effects from minimum wages experienced by those aged 20-24. For example, Neumark and Wascher (2001) report stronger adverse effects of minimum wages on training of 20-24 year-olds than teenagers, and evidence presented later in this paper suggests that facing higher minimum wages in the older age range reduces completed schooling. These effects on training and schooling of those in their early 20's are not surprising, as these are ages at which jobs are more likely to entail training in the first place (as shown in Neumark and Wascher, 2001) and at which many individuals are still on the margin between staying in or

[22] 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.

[23] The estimate of −9.40, multiplied by the average log minimum wage gap of 0.07, coupled with an average employment rate of 46.5 percent for teenagers, implies a 1.4 percent decline in employment, which dividing by the approximately 7 percent higher minimum yields the −0.20 elasticity.

leaving school. Thus, despite the evidence in Table 4, longer-run adverse effects of minimum wages could stem from exposure in the teens or the early 20's.

Cumulative Minimum Wage 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 Table 6, which reports estimates of equation (2) using the cumulative minimum wage exposure measure. To interpret the estimates, we calculate their implications for the effects of exposure since age 16 to a minimum wage that is on average higher by 0.06 log points. This is the difference between states with and without higher contemporaneous minimum wages faced by teens and young adults—as shown in the first row of estimates in Table 4—and it is exposure at these ages on which we focus most of our attention. Based on the estimates in Table 6, for 16-19 and 20-24 year-olds the implied effect of this exposure to a higher minimum wage is a 1.1-1.2 percent higher contemporaneous wage. But for 25-29 year-olds the estimated longer-run effect of exposure to a higher minimum is negative and larger, potentially reflecting longer-run cumulative effects of exposure to a higher minimum wage in the past; we return to this question below.

Turning to the employment and hours results, in columns (2) and (3), the estimated exposure effects are negative and statistically significant for all three age groups for both employment and hours (in some cases at the ten-percent level). For 20-24 year-olds, for example, the cumulative effect of exposure to a higher minimum wage since age 16 is to reduce hours by 0.36, or 1.4 percent.

Finally, column (4) reports the earnings effects. For teenagers there is a negative and insignificant effect. For 20-24 year-olds the estimated effect is small and insignificant. And for 25-29 year-olds the effect is negative, quite large, and statistically significant. For this oldest group, the estimates imply that an individual exposed to same average current difference in minimum wages we have used throughout earns 3.6 percent less because of exposure to a higher minimum wage.[24] Those

[24] 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

older individuals exposed to a higher minimum wage also have lower employment and hours. These latter estimates suggest that by the time they reach the age when almost everyone has left school, detrimental effects of longer-term exposure to a high minimum wage become evident.

Exposure at Different 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 7. To summarize briefly, although there is not much evidence of effects of past exposure to higher minimum wages on 20-24 year-olds, for 25-29 year-olds the evidence points quite clearly to adverse effects of exposure to higher minimum wages at younger ages. It makes sense that it is only for the older group that these effects become apparent, as 20-24 year-olds are often still enrolled in school (which may itself be influenced by the minimum wage), and if working are more likely to be observed well before the overtaking age. Both of these influences imply that for this younger group it will be more difficult to infer the effects of minimum wages. For example, if minimum wages deter training, then at very young ages during which workers receiving training are paid lower wages, adverse effects of minimum wages on wages would be obscured. And if minimum wages cause young adults to leave school earlier and to seek employment, then at ages when many are still in school an adverse employment effect of minimum wages would be masked. Consequently, we view the estimates for 25-29 year-olds as most informative.

Looking first at wages, the estimates for exposure at younger ages (16-19 and 20-24) are negative and statistically significant in both cases. The estimates imply, for example, that exposure to the average higher minimum wage during ages 16-19 reduces "adult" wages by about 1.3 percent ($0.06 \cdot 0.215$). The effects for exposure of 20-24 year-olds is a shade weaker. This evidence points to adverse longer-run effects on wages of exposure to high minimum wages during one's early years in the labor market. 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.

evidence on employment and hours similarly points to adverse longer-run effects of exposure to a high minimum wage when young, with the estimates higher in absolute terms for exposure at ages 20-24. For 25-29 year-olds, exposure to the average higher minimum wage during ages 20-24 reduces hours by about 0.4 hour, or 1.3 percent.

The final column of Table 7 reports results for earnings. Here, again, there is strong evidence of negative longer-run effects of exposure to minimum wages as a teenager or young adult, as the estimated longer-run effects for exposure both as a teenager and a young adult are negative and statistically significant for 25-29 year-olds. For example, exposure to the average higher minimum wage, as a teenager, is estimated to reduce weekly earnings as an adult by 1.8 percent, and similar exposure as a 20-24 year-old to reduce weekly earnings by 2.3 percent. 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. Later, we consider more carefully how these effects might arise.

Effects of Exposure by Race

Next, we turn to results estimated separately for whites and blacks.[25] As a preliminary, Table 8 reports 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, 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 regression results described below confirm this.

[25] 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.

Panel A of Table 9 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 teenagers, as discussed earlier.

The next specifications, in Panel B of Table 9, 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. The evidence points quite clearly to more adverse longer-run effects of minimum wages for blacks. Focusing again on the estimates for 25-29 year-olds, we find that, for blacks, exposure to a higher minimum wage during ages 16-19 or 20-24 is associated with significant negative reductions in wages, employment, hours, and earnings. The estimates for whites are often about one-quarter to one-third as large, although still generally statistically significant.

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.[26] However, the racial differences in the longer-run effects, in Panel B, seem much more pronounced than the racial differences in the contemporaneous effects in Panel A, although the estimates for 20-24 year-olds in Panel B suggest that at these ages the contemporaneous adverse effects of minimum wages are more severe for blacks. A potential additional factor that may amplify the race differences is that minimum wages and the ensuing disemployment effects may lead to increased criminal

[26] 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).

activity.[27] 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.[28] But 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 and young adults, 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). At this point, though, this explanation of the race differences in longer-run effects of minimum wages is speculative.

The results by race are inherently interesting given the focus on race differences in the effects of minimum wages in the earlier contemporaneous effects literature, 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.

[27] See Grogger (1998) for a discussion of research on race differences in participation in crime.

[28] 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).

Exposure to Differing Economic Conditions

Our estimates thus far have focused on the effects of a history of exposure to high minimum wages on wages, earnings, and work. However, the only history that we have included in our equations estimated thus far is the minimum wage history. The history of economic conditions to which one was exposed as a youth may also affect subsequent labor market outcomes,[29] and if this history is correlated with the minimum wages to which one was exposed when younger, then the preceding estimates may be biased. We therefore augment the specifications from Table 7, for 25-29 year-olds, with controls for exposure to unemployment rates.

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 therefore should not be much influenced by changes in employment, hours, etc., for a narrow age group. Moreover, we omitted the contemporaneous unemployment rate to avoid this problem. Nonetheless, 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.

The estimates in Table 10 indicate that the history of unemployment rates to which individuals were exposed does in fact impact contemporaneous outcomes, with numerous cases (six out of eight) where higher past unemployment rates have negative effects on current wages, employment, hours, and earnings.[30] Moreover, the estimated minimum wage effects moderate as a result of the inclusion of the unemployment history. In particular, the wage and earnings effects of exposure to a higher minimum wage as a teenager fall by a third or more, while remaining significant (at the ten-percent level or better). The effects of exposure to a higher minimum wage at ages 20-24 do not fall nearly as much, declining by about one-quarter to one-third, with all of the estimates remaining statistically significant. We read the

[29] Mroz and Savage (2003) study the longer-term effects of earlier spells of unemployment. See also Beaudry and DiNardo (1991).
[30] 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.

results as indicating that the evidence of adverse longer-run effects of exposure to a higher minimum wage in the early 20's is quite strong and robust, while that for exposure as a teen is a bit weaker. Finally, these findings also suggest that the longer-run adverse effects of minimum wages may be more attributable to the lasting impact of effects of minimum wages on training and schooling than on employment or hours, since—as shown in Table 5—there is little evidence of the latter effects for 20-24 year-olds.

Another relevant set of influences on young individuals' labor market experiences is changes in welfare and taxes. For example, as documented in Meyer and Rosenbaum (2001), the 1990s—and especially the late 1990s after welfare reform—witnessed sharp changes in welfare and tax policy that strongly affected work incentives among single mothers. It is unlikely that these drive our results. For 25-29 year-olds, in particular, very little identifying information comes from the late 1990s, as the sample ends in 2001 and we are estimating the effects of minimum wages many years earlier.[31]

The Minimum Wage "History" and Migration

Next, 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 of negative effects of past exposure to higher minimum wages seems unlikely to be attributable to this measurement error.

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

[31] We also computed estimates separately for males and females. If the minimum wage effects we have found thus far represent effects of omitted changes in these types of policies, we might expect quite different results for men and women, with the effects more apparent for women. As it turns out, though, the evidence of longer run effects of minimum wages is relatively similar for males and females, and if anything somewhat stronger for males. While indirect, this is suggestive evidence that the minimum wage effects we detect do not primarily reflect these other changes in work incentives.

effects; that is, migration should arbitrage away some of the costs or benefits of higher minimum wages. Thus, for example, less-skilled teenagers or young adults 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., would be generated by exposure to a high minimum wage. 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.[32]

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 and 25-29 in 1990 or 2000, who were therefore teenagers or young adults five years earlier (age ranges for which the earlier estimates indicated adverse effects from exposure to high minimum wages), 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 and 16 percent for 25-29 year-olds.[33] We then matched these records to the effective minimum wage by state and year, and estimated a regression model for the change in the minimum wage 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

[32] 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 points to 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.

[33] 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 that arise simply because of changes in the minimum wage in the state in which one resides.

because of skill or discrimination) exhibit a tendency to move to states with higher or lower minimum wages.

The estimates are reported in Table 11. With respect to education, sex (in the 1990 data), and race (in the 2000 data), characteristics associated with lower wages and skills are also associated with moves to states with lower minimum wage gaps. For these three cases, then, the evidence is consistent with the conjecture that lower-wage or lower-skill workers, when they move, migrate to states with lower rather than higher minimum wages; such a migration pattern would if anything bias our earlier estimates against finding adverse effects of exposure to a high minimum wage as a teenager. Some of the result go the other way, however, in particular for Hispanics in both years, and for race in the 1990 data.[34] 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.

Accounting for the Longer-Run Effects of Minimum Wages

The key evidence points to longer-run negative effects on earnings of exposure to higher minimum wages at earlier ages when minimum wages were more likely to have been binding. It is instructive to think about the magnitudes of the estimated earnings effects reported in Tables 7 and 10 to try to understand what might underlie the adverse longer-run effects of minimum wages that we find. Given the stronger results for exposure in the early 20's, we focus on the effects of exposure at these ages on 25-29 year-olds. We use the same type of calculation we have been using throughout. More specifically, in this section we consider the effects of exposure of 20-24 year-olds to an average minimum wage higher by 0.06 log points. Averaging the earnings estimates in Tables 7 and 10, the resulting coefficient (0.336) implies that exposure to this higher minimum wage through the 20-24 period reduces average earnings of 25-29 year-olds by 2.0 percent. This seems like a large effect, and it is therefore

[34] 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.

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, training, and schooling.[35]

The most direct effect would arise through lower current (i.e., adult) employment and hours stemming from exposure to a higher minimum wage earlier, of which there is evidence in columns (2) and (3) of Tables 7 and 10. For example, these effects may arise because the lower wage reduces labor supply. Using the average of the unconditional hours estimates in the two tables (yielding −5.734), which account for both employment and hours variation for the employed, the estimated effect on hours implies a 1.09 percent reduction in unconditional hours and hence a similar reduction in earnings.[36] Thus, the contemporaneous labor supply effect accounts for just over half of the earnings decline. 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 earlier exposure to a higher minimum wage, 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 estimated contemporaneous effect of minimum wages on 20-24 year-olds from Table 7 implies that exposure to a higher minimum lowers unconditional hours of work for 20-24 year-olds by 0.65 percent. If each year of full-time experience is worth, say, four percent higher wages, then this implies 0.1 percent ($0.04 \cdot 0.0065 \cdot 4$) lower earnings, on average, for employed individuals, or 0.08 percentage point lower earnings unconditionally, which would account for another 4.0 percent of the earnings decline for 25-29 year-olds (0.08/2.0). Accounting for tenure effects would be expected to increase this effect, although it is difficult to say by how much since we do not know how this disemployment would have affected later tenure; arguably the effect would be relatively small because young workers change jobs frequently.

[35] 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.
[36] Lower current hours could also help account for lower wages conditional on working.

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 young adults.

The negative longer-run effects of minimum wages could also occur through decreased skill accumulation. There is evidence from CPS data that minimum wages reduces formal training for 20-24 year-olds (Neumark and Wascher, 2001, Table 3), with the evidence implying that a representative higher minimum (using the 7.3 percent figure from above) reduces the incidence of training by about 1.0 percentage points, or about 10 percent. With an estimated return to this training of about 18 percent, this implies an additional 0.18 percent (0.18·0.01) reduction in the average wage;[37] because this estimate comes from a sample that conditions on employment, given the employment rate for this age group this would translate into 0.14 percent reduction in average earnings, accounting for an additional 7.0 percent of the earnings decline.

Another avenue for skill reduction stemming from higher minimum wages comes through school enrollment. Here, rather than relying on past findings, we can simply adopt our regression framework to directly assess the longer-run effects of exposure to a higher minimum on schooling. As reported in Table 12, looking at both the percentage with a high school degree or higher level of educational attainment, and years of schooling,[38] the estimated effects of exposure as a 20-24 year-old (as well as a teen) on schooling of 25-29 year-olds were negative and statistically significant. Using the years of schooling estimate, the coefficient implies that the exposure we are considering reduces schooling by 0.072 years, which multiplied by a return to schooling of 0.07 implies an average 0.5 percent reduction in earnings conditional on employment or 0.4 percent unconditionally, accounting for another 20 percent of the earnings reduction.

The estimates discussed in this subsection are only intended to be suggestive. Adding them up, though, suggests that standard labor supply and human capital channels—such as lower current employment and hours, reduced training and schooling, and foregone work experience as a teenager—

[37] The training estimates used in this calculation are from Table 3 (average for column (2')), Table 2 (column (2)), and Table A1 (column (2')) of Neumark and Wascher (2001).

[38] It is less appropriate to estimate these models for younger individuals, for whom schooling may not be completed.

may be able to explain about 86 percent ({1.09 + 0.08 + 0.14 + 0.4}/2.0) of the longer-run effects of minimum wages that we find. In that sense, our estimates appear reasonable. Of course there may be additional influences generating the longer-run effects of minimum wages, such as the scarring effects of early non-employment that deter the formation of good work habits, a reputation as a good worker, labor market networks, etc. These types of influences can account for adverse effects on earnings that are not captured in the costs of foregone experience. Also, the returns to experience are identified largely from voluntary variation in experience, such as from when one leaves school. It is plausible, though, that spells of involuntary non-employment are more costly.[39]

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 minimum wages—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 more 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. The evidence indicates that 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 as a teen and young adult. Furthermore, the adverse longer-run

[39] These findings and this conjecture 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. However, they do not focus on minimum wage effects per se, and do not distinguish between voluntary and involuntary spells of unemployment. Ruhm (1991) reports evidence of long-term negative earnings effects associated with job displacement, which better captures involuntary spells of non-employment.

effects of exposure to higher minimum wages when young are stronger for blacks, presumably reflecting in part, at least, the greater extent to which minimum wages are binding for these groups. In our view, this evidence 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 adverse minimum wage effects that are manifested in the longer run.

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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												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 Average Effective State Minimum Wage, Oregon

	89	90	91
State minimum wage	--	4.25	4.75
Federal minimum wage	3.35	3.80	4.25
Average effective state minimum wage, all ages	16-24: 3.35 25: (1/10)·3.10 + (9/10)·3.35 … 29: (2/14)·2.30 + (1/14)·2.65 + (1/14)·2.90 + (1/14)·3.10 + (9/14)·3.35	16: 4.25 17: (1/2)·3.35 + (1/2)·4.25 18: (2/3)·3.35 + (1/3)·4.25 … 29: (1/14)·2.30 + (1/14)·2.65 + (1/14)·2.90 + (1/14)·3.10 + (8/14)·3.35 + (1/14)·4.25	16: 4.75 17: (1/2)·4.25 + (1/2)·4.75 18: (1/3)·3.35 + (1/3)·4.25 + (1/3)·4.75 … 29: (1/14)·2.65 + (1/14)·2.90 + (1/14)·3.10 + (7/14)·3.35 + (1/14)·4.25 + (1/14)·4.75
Average effective state minimum wage exposed to age ages 16-19	20: 3.35 … 29: (1/2)·2.30 + (1/4)·2.65 + (1/4)·2.90	20: 3.35 … 29: (1/4)·2.30 + (1/4)·2.65 + (1/4)·2.90 + (1/4)·3.10	20: (1/4)·3.80 + (3/4)·3.35 … 29: (1/4)·2.65 + (1/4)·2.90 + (1/4)·3.10 + (1/4)·3.35

See Table 2 for the federal minimum wage series extending back to 1973.

Table 4: Summary Statistics

	16-19 year-olds			20-24 year-olds			25-29 year-olds		
	Whole sample	Current state min. wage > federal	Federal min. wage prevails currently	Whole sample	Current state min. wage > federal	Federal min. wage prevails currently	Whole sample	Current state min. wage > federal	Federal min. wage prevails currently
Observations	4692	692	4000	5712	856	4856	4590	789	3801
Log of effective state minimum wage, current ($2001)	1.688 (0.092)	1.746 (0.087)	1.678 (0.089)	1.683 (0.088)	1.744 (0.085)	1.673 (0.084)	1.655 (0.068)	1.734 (0.077)	1.639 (0.052)
Average effective log of state minimum wage since age 16 ($2001)	1.694 (0.092)	1.740 (0.087)	1.685 (0.091)	1.704 (0.087)	1.733 (0.083)	1.699 (0.088)	1.697 (0.068)	1.732 (0.068)	1.689 (0.066)
Employment (%)	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)
Wage ($2001)	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)
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)
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)
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)

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. Means of these observations are reported, with standard errors of these means reported in parentheses. "Average effective state minimum wage since age 16" is calculated inclusive of age 16. In computing mean weekly earnings, observations on individuals employed but not 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. Minimum wages, wages, and earnings are converted to 2001 dollars 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 Current Log of State Minimum

	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)
16-19				
Effective log state minimum wage, current	0.2216** (0.0693)	-9.4008+ (5.1854)	-2.2123 (1.4551)	-0.0607 (0.2390)
R^2	0.78	0.86	0.91	0.91
20-24				
Effective log state minimum wage, current	0.0102 (0.0590)	-2.4059 (2.9786)	-0.4954 (1.4671)	0.0128 (0.1004)
R^2	0.80	0.64	0.74	0.82
25-29				
Effective log state minimum wage, current	-0.0048 (0.0554)	2.2494 (2.8554)	1.0103 (1.4064)	0.0258 (0.0910)
R^2	0.77	0.48	0.52	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 (distinguished by year or age) 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 Average Effective Log State Minimum Wage Since Age 16

	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)
16-19				
Average effective log state minimum wage since age 16	0.1914** (0.0602)	-11.8109* (4.7417)	-2.4776* (1.2525)	-0.2783 (0.2364)
R^2	0.78	0.86	0.91	0.91
20-24				
Average effective log state minimum wage since age 16	0.1944** (0.0666)	-11.3323** (4.3730)	-5.9440** (1.9027)	-0.0828 (0.1121)
R^2	0.81	0.64	0.74	0.82
25-29				
Average effective log state minimum wage since age 16	-0.3192** (0.1021)	-19.2979** (5.0667)	-9.8015** (2.5440)	-0.5928** (0.1440)
R^2	0.77	0.48	0.53	0.71

See notes to Table 5.

Table 7: Estimated Effects of Average Effective Log State Minimum Wage by Age of Exposure

	(1)	(2)	(3)	(4)
	Log(wage)	Percent employed	Hours	Log (weekly earnings)
20-24				
Average effective state minimum wage, 16-19	0.1067** (0.0331)	-3.6759 (2.5398)	-2.1364+ (1.1383)	-0.0170 (0.0680)
Average effective state minimum wage, 20-24	0.1033* (0.0519)	-3.6115 (3.1615)	-2.7972+ (1.5123)	0.0131 (0.0933)
R^2	0.81	0.64	0.74	0.82
Observations	5712	5712	5712	5712
25-29				
Average effective state minimum wage, 16-19	-0.2150** (0.0485)	-5.7487* (2.7085)	-2.7991* (1.3059)	-0.3024** (0.0682)
Average effective state minimum wage, 20-24	-0.1894** (0.0456)	-11.0518** (2.6619)	-6.6298** (1.3428)	-0.3807** (0.0726)
Average effective state minimum wage, 25-29	0.0351 (0.0450)	-1.6490 (2.2380)	-1.0418 (1.1492)	0.0010 (0.0692)
R^2	0.77	0.48	0.53	0.71
Observations	4590	4590	4590	4590

See notes to Table 5.

Table 8: 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	4788	4590	3845
Log of effective state minimum wage, current	1.688 (0.092)	1.689 (0.093)	1.683 (0.088)	1.684 (0.089)	1.655 (0.068)	1.655 (0.068)
Average effective log of state minimum wage since age 16	1.694 (0.092)	1.694 (0.093)	1.703 (0.087)	1.705 (0.088)	1.697 (0.068)	1.698 (0.069)
Employment %	49.85 (14.63)	29.05 (25.38)	73.02 (8.85)	56.43 (26.93)	80.58 (6.81)	68.87 (24.51)
Wage	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
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
Weekly earnings, 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
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 9: Estimated Effects of Current State Minimum and Average State Minimum Wage by Age of Exposure, 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								
Effective log state minimum wage, current	0.2066**	-9.6879*	-1.7986	-0.0104	0.2954*	-11.1330	-2.8317	0.0215
	(0.0762)	(4.7510)	(1.3699)	(0.2168)	(0.1367)	(7.0460)	(2.0275)	(0.6204)
R^2	0.77	0.83	0.91	0.90	0.40	0.51	0.61	0.62
B. Exposure specifications:								
20-24								
Average effective log state minimum wage, 16-19	0.1171**	-2.7625	-1.4824	0.0175	0.1542+	-10.7862	-4.4699+	-0.0474
	(0.0373)	(2.5750)	(1.2198)	(0.0717)	(0.0795)	(6.5654)	(2.5999)	(0.1841)
Average effective log state minimum wage, 20-24	0.1115*	-0.6500	-1.4948	0.0797	-0.0566	-9.8050	-6.2448*	-0.1655
	(0.0553)	(3.3735)	(1.6421)	(0.0923)	(0.0950)	(6.7012)	(2.6323)	(0.1903)
R^2	0.79	0.56	0.70	0.80	0.46	0.39	0.48	0.51
25-29								
Average effective log state minimum wage, 16-19	-0.2178**	-0.3870	-0.3206	-0.2376**	-0.5349**	-32.1744**	-16.4728**	-1.0828**
	(0.0508)	(2.7329)	(1.3556)	(0.0700)	(0.1228)	(8.9942)	(3.7619)	(0.2037)
Average effective log state minimum wage, 20-24	-0.1872**	-7.0702*	-4.8671**	-0.3267**	-0.4864**	-26.8465**	-15.1759**	-0.9812**
	(0.0493)	(2.7535)	(1.4209)	(0.0758)	(0.1108)	(7.7896)	(3.3653)	(0.1788)
Average effective log state minimum wage, 25-29	-0.0010	-0.9717	-0.5264	-0.0190	0.0046	-4.1159	-1.5088	-0.0437
	(0.0524)	(2.3156)	(1.1771)	(0.0749)	(0.0978)	(7.1327)	(2.9712)	(0.1537)
R^2	0.74	0.46	0.50	0.68	0.46	0.29	0.34	0.36

Specification in Panel A corresponds to columns (1)-(4) of Table 5. Specifications in Panel B correspond to Table 7. See notes to Table 5 and 8.

Table 10: 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)
25-29				
Weighted exposure, 16-19	-0.0829+ (0.0463)	-1.0426 (2.8212)	-0.4219 (1.3118)	-0.1012* (0.0617)
Weighted exposure, 20-24	-0.1468** (0.0459)	-7.6701** (2.7586)	-4.8380** (1.3528)	-0.2908** (0.0720)
Weighted exposure, 25-29	-0.0340 (0.0428)	-4.2832+ (2.2731)	-2.3793* (1.1284)	-0.1072 (0.0660)
Average UR, 16-19	-0.0061** (0.0012)	0.0904 (0.0734)	0.0590+ (0.0348)	-0.0049** (0.0017)
Average UR, 20-24	-0.0161** (0.0015)	-0.4409** (0.0760)	-0.2170** (0.0354)	-0.0226** (0.0019)
R^2	0.79	0.49	0.54	0.73
Observations	4590	4590	4590	4590

See notes to Table 5.

Table 11: Relationship Between Wage- and Skill-Related Variables and Change in Minimum Wage for Movers, 25-29 Year-Olds

	Change in log of effective minimum wage			
	1990 PUMS		2000 PUMS	
	(1)	(2)	(3)	(4)
	20-24	25-29	20-24	25-29
Education less than high school	-0.0024** (0.0004)	-0.0023** (0.0004)	-0.0024** (0.0008)	-0.0043** (0.0008)
Female	-0.0009** (0.0003)	-0.0011** (0.0002)	0.0004 (0.0005)	-0.0003 (0.0004)
Non-white	0.0013** (0.0004)	0.0016** (0.0004)	-0.0027** (0.0006)	-0.0020** (0.0005)
Hispanic	0.0096** (0.0006)	0.0080** (0.0005)	0.0048** (0.0008)	0.0020** (0.0008)
Observations	100,454	149,668	98,560	134,483
R^2	0.0003	0.0019	0.0005	0.0004
Share of movers in age group	0.1283	0.1572	0.1303	0.1613
Change in log effective minimum wage, mean	-0.0336 (0.0448)	-0.0341 (0.0448)	0.0900 (0.0751)	0.0913 (0.0754)

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.

Table 12: Estimated Effects on Schooling of Average State Minimum Wage by Age of Exposure

	(1)	(2)
	Percentage with high school degree or higher education	Years of schooling
25-29		
Average effective state minimum wage, 16-19	-7.0313** (2.2168)	-0.8145** (0.2093)
Average effective state minimum wage, 20-24	-7.4778** (2.4633)	-1.1940** (0.2385)
Average effective state minimum wage, 25-29	0.7907 (2.3264)	-0.0359 (0.2185)
R^2	0.61	0.79
Observations	-7.0313**	-0.8145**

For 1979-1991 high school degree 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.)