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Effects of Higher Minimum Wages on Teen Employment and School Enrollment

by

Mark D. Turner and Berna Demiralp
Johns Hopkins University

July 2000

Prepared for the W.T. Grant Foundation, grant #: 98186498. We thank Pam Lopest, Robert Lerman, William Rodgers, and William Spriggs for their helpful comments and suggestions. We also thank Michelle DeLair for excellent research assistance. Mark Turner is a research scientist at the Institute for Policy Studies, and Berna Demiralp is a graduate student in the Department of Economics.

Abstract

Both Congress and the Senate recently passed legislation increasing the federal minimum wage from $5.15 to $6.15 per hour. Proposals to increase the federal minimum wage have lately received popular support from the public and politicians from "both sides of the aisle." Nonetheless, the research community continues to question the efficacy of increasing minimum wages, at both the state and federal levels.

This study analyzes the effect of higher minimum wages on teen employment and school enrollment using a large, nationally representative longitudinal dataset, the Survey of Income and Program Participation. We show how recent minimum wage hikes affect teenagers in general and key demographic subgroups among the teenage population. Opponents of the minimum wage hike contend that minimum wage increases reduce employment and prompt some teens to drop out of school. Moreover, opponents maintain that a higher minimum wage has a more negative impact on younger teens, blacks and Hispanics compared to older teens, and nonblack and non-Hispanic teens. Proponents of the minimum wage hike argue that the job-loss effect to be either small or nonexistent. This research, summarized in Bernstein and Schmitt (1998), suggests that the benefits of minimum wage increases to low-wage workers and their families far outweigh the costs.

Our results initially appear to suggest that the proposed minimum wage hike would significantly increase teen employment and would slightly reduce school enrollment. In addition, we find that the proposed minimum wage hike would decrease the probability of becoming idle, i.e., not-enrolled and not-employed, among the entire teenage population. However, consistent with Neumark and Wascher's 1995 study, our findings indicate that black and Hispanic teens and teens in central cities are more likely to become idle as a result of the proposed minimum wage increase.

Introduction

Economists and policymakers once again find themselves engaged in a heated debate, as legislation awaits the President's signature to increase the federal minimum wage from $5.15 to $6.15 per hour. A neglected, yet important component of this debate is the effect of minimum wage hikes on teenagers' school enrollment and employment. The scant number of studies on this issue have yielded contradictory findings, rendering the question of minimum wages' effects on school enrollment and employment of teenagers unresolved.

The impact of a higher minimum wage on the teenage employment and school enrollment is an important issue to policymakers, given the demographics of minimum wage workers. Current statistics based on the March 1998 Current Population Survey show that teenagers between the ages of 16 and 19 represent 27.3 percent of workers who would be directly affected by the proposed increase (Turner, 1999). Furthermore, a vast majority, 66.5 percent, of teens and young adults who would be directly affected by the proposed minimum wage are also enrolled in school.

While a large body of the literature solely examines the employment effects, only a few studies have investigated the impact of minimum wage hikes on teens' joint employment and educational attainment decisions. We agree with Ben-Porath (1967) in that educational attainment and employment are jointly determined and that more research should be focused on how labor market policies influence this joint decision-making. With this motivation, we explore, in this paper, the impact of higher minimum wages on teen employment and school transitions. We analyze the economic consequences of an increased minimum wage on teenagers in general and key demographic subgroups among the teenage population.

We contribute to the existing literature by using data from Survey of Income and Program Participation, which we consider to be a well-suited dataset for following teens over time. Our methodological approach is nearly identical to that used by Neumark and Wascher (1995). Our findings are mostly consistent with Neumark and Wascher's study. For example, black and Hispanic teens and teens in central city are more likely to become idle, i.e. not-enrolled and not-employed, as a result of the minimum wage increase. Inconsistent with their findings, we find that the proposed minimum wage hike would increase overall teen employment and decrease the probability of idleness.

In the next section, we review the existing literature and discuss this study's contribution. In Section III, we discuss the dataset and variable definitions, and in Section IV we explain the methodology used in this paper. In Section V, we summarize our empirical results and in the last section discuss their policy implications.

Literature Review

Economic theory and empirical evidence suggest that a minimum wage hike would more likely affect teens than any other age group, since teens hold a large fraction of minimum wage jobs. Thus, a great deal of the literature examines the economic impact of minimum wage increases on teens. Researchers have traditionally examined teens between the ages of 16 and 19 because most nationally representative surveys only ask about the employment status for respondents who are 16 years and older[1].

The majority of the minimum wage literature focuses on teen employment. Recent empirical studies on the impact of minimum wage hikes on teen employment are quite diverse in their data, methodologies, and findings. When these studies are grouped according to their findings, two distinct patterns emerge. Some studies find that a higher minimum wage is correlated with lower employment (Neumark & Wascher, 1996; Deere, Murphy, & Welch, 1995; Kim & Taylor, 1995; Currie & Fallick, 1996), while others conclude that a higher minimum wage has insignificant or positive effects on teen employment (Wellington, 1991; Card & Krueger, 1995). From a theoretical perspective, the former findings are consistent with the "textbook" analysis of labor markets in which a wage floor brings about a reduction in employment (Brown, Gilroy, & Kohen, 1982). The latter findings—insignificant and/or positive employment effects of higher minimum wages on teen employment—are usually explained by a monopsony model of labor markets[2]. Although several studies in recent years have attempted to reconcile these opposing findings under various theoretical models (Baker, Benjamin, & Stanger, 1999), the effects of a minimum wage increase on teenage employment remains a controversial issue.

A “smaller body” of literature investigates the theoretically ambiguous effect of minimum wage increases on teens’ school enrollment and employment decisions. Theory suggests that a higher minimum wage makes employment more attractive and school relatively less attractive, causing some teens to substitute employment for school enrollment. On the other hand, if a higher minimum wage increases the expected lifetime income of teens and education is a normal good, then we would expect a higher minimum wage to increase school enrollment (income effect). This ambiguity in the possible impact of higher minimum wages on educational attainment adds another dimension of social cost and/or benefit to the already heated debate.

Unlike the employment effects of the minimum wage, teens’ jointly determined school enrollment and employment status has not received much attention. To date, only a few studies have examined this issue (Mattila, 1981; Cunningham, 1981; Ehrenberg & Marcus, 1982; Neumark & Wascher, 1995). Using data from the October School Enrollment files of the Current Population Survey (CPS), Mattila found that moderate increases in the minimum wage raised youth unemployment. However, teenagers not enrolled in school did not lose their jobs when the minimum wage increased; the persons displaced in the labor market tended to be enrolled youth. Moreover, Matilla concluded that increases in the minimum wage were positively correlated with school enrollment rates. Cunningham used decennial census data from 1960 and 1970 and found that a higher minimum wage reduced school enrollment rates for white teenagers but increased those for black teenagers. Ehrenberg and Marcus, using cross-section data from the National Longitudinal Surveys, found that minimum wage increases induced white teens from high-income families to work less, i.e. move from enrolled/employed status to enrolled/nonemployed status, while enticing teens from low-income families to reduce their educational attainment, i.e. shift from enrolled/employed to nonenrolled/employed status.

In contrast to some of the earlier studies, Neumark and Wascher used individual-level data and multivariate econometric models to examine the effects of minimum wage hikes on teen employment and school enrollment transitions. Based on their results, Neumark and Wascher concluded that a higher minimum wage increased the probability that more-skilled teenagers displace lower skilled workers from their jobs resulting in a negligible, net disemployment effect. They found that a higher minimum wage increased the probability that teenagers leave school for work or work more hours. They also found that black or Hispanic teenagers were more likely to become disemployed and remain unemployed than nonblack, non-Hispanic teenagers. Their analysis by age suggested that in response to a higher minimum wage, 16-17 year-olds, who were initially not-enrolled/employed, became disemployed and remained out of school while 18-19 year-olds, who were originally enrolled and employed, remained employed but dropped out of school. This study has two main shortcomings.

First, Neumark and Wascher's measure of school enrollment tends to misclassify students as nonstudents. Using the May Current Population Survey (CPS), they counted teenagers as enrolled only if they reported their *major activity* during the survey week as "going to school." If a student reported his *major activity* as working, he was not asked about school enrollment and was therefore not classified as enrolled. Research by Evans and Turner (1995), using the October CPS, shows that the Neumark and Wascher measure of school enrollment systematically understates the proportion of teens in school by 7.4 percentage points and understates full-time enrollment by 5.6 percentage points. Notably, the definition of school enrollment affects estimates of whether a higher minimum wage significantly alters teens' school enrollment and employment status. Neumark and Wascher found that an increase in the minimum wage depressed school enrollment and employment, where as Evans and Turner, using a more precise measure of school enrollment, but otherwise identical specifications, found that the minimum wage did not affect school enrollment and had a negligible effect on employment.

Second, using the CPS to analyze transitions in employment and school enrollment results in an analytical sample predisposed to *exclude* respondents who shift from not-enrolled to enrolled and shift from not-employed to employed. Consequently, estimates based on CPS data may mistakenly suggest that a higher minimum wage decreases employment and induces teens to drop out of school. Neumark and Wascher (1995) used the CPS and attempted to match teenagers, 16 to 19 years old, for the same months across two consecutive years. Roughly one-third of the CPS teenagers sampled each year cannot be matched with data from the previous year. Since the CPS is a survey that follows addresses rather than individuals over time, this matching problem tends to reflect changes in residence, which often accompany shifts in schooling and employment status. Peracchi and Welch (1995), for example, found that attrition from the CPS is concentrated among youth, and is the result of household and individual mobility due to decisions about schooling, family formation, and job search.

Contribution to the Literature

Our research enhances understanding of the economic consequences resulting from an increase in the minimum wage. First, we use variables that more accurately measure enrollment. Second, instead of using the CPS, we use data designed for longitudinal analyses. Our analysis relies on the SIPP, a household survey that attempts to follow all individuals in households surveyed during the initial interview. Third and similar to earlier studies, we empirically test the hypothesis that the minimum wage has differential effects on employment and on school enrollment across racial, gender, and socioeconomic groups. This examination of differential effects is important because theoretical models imply that a higher minimum wage disproportionately harms the employment opportunities and educational outcomes of minorities, females, and economically disadvantaged teens. Thus, a minimum wage hike *could* inadvertently exacerbate the already dismal employment opportunities and educational attainment for black and Hispanic teens, compared with their white counterparts.

Data

We use the 1990 Survey of Income and Program Participation (SIPP) to examine the impact of minimum wage hikes on teens' school enrollment and employment. SIPP is a rich longitudinal and stratified national probability sample of individuals in the United States. It contains detailed information on the respondents' school enrollment and employment status, age, gender, race, household composition, and state of residence. SIPP is particularly suited for this analysis because it attempts to follow teens if they move out of their parents' household. Overall attrition of teenagers from SIPP is relatively low at 18.9 percent, translating into 1,359 respondents who did not complete the follow-up interview.

The analytical dataset includes 2,747 teens who are 16 to 19 years old during the initial interview in the 1991 school year (January through April). These same teens are reinterviewed the following year when they are 17 to 20 years old[3]. The main dependent variable, teens' school enrollment and employment status, is a categorical variable with the following four outcomes: enrolled/ employed (SE), enrolled/not-employed (SNE), not-enrolled/employed (NSE), and not-enrolled/not-employed (NSNE). In 1991, when the respondents are 16 to 19 years old, 47.6 percent are enrolled and not employed, 32.6 percent are enrolled and employed, 10.6 percent are not enrolled and employed, and 9.2 percent of teens are idle—not enrolled and not employed. In the following year, when the respondents are 17 to 20 years old, 39.8 percent are enrolled and not employed, 29.6 percent are enrolled and employed, 18.9 percent are not enrolled and employed, and 11.7 percent of teens are idle—not enrolled and not employed.

Employers in each state must pay their employees the higher of the state and federal minimum wages, which is the effective minimum wage. During the analysis period, 1991 through 1992, the federal minimum wage increased by 45 cents, from $3.80 to $4.25 per hour. Twelve states in 1990 and eight states in

1991 had binding state minimum wages that exceeded the federal minimum wage (Table 1). Unfortunately, the SIPP does not uniquely identify nine small states—Maine, Vermont, Iowa, North Dakota, South Dakota, Alaska, Idaho, Montana, and Wyoming. Therefore, respondents residing in these states are excluded from our data set.

We use three different minimum wage indices: lagged effective minimum wage, bound dummy variable, and wage gap. First, similar to other research, we use the effective minimum wage level lagged by 12 months. The minimum wage variable is lagged to account for the lapse between the time that minimum wage increase is in effect and the time that teens react to this change. Second, we include a dichotomous variable that indicates whether employed teens would be directly affected by a minimum wage increase. We consider a respondent to be bound by the change if his hourly wage in 1991 is less than the new minimum wage. Observations with reported hourly wages greater than $40 are excluded from the sample. Of employed teens, 71.7 percent are bound by both federal and state minimum wage increases in 1991-92. Third, the wage gap is defined for employed respondents as the difference between their hourly wage in 1991 and the effective minimum wage in 1992. The average wage gap of bound employed teens is 53 cents, and is $1.21 for nonbound employed teens.

Methodology

Our methodological approach is nearly identical to that used by Neumark and Wascher (1995). We use a multinomial logit specification to estimate the impact of the minimum wage hikes on teens' school enrollment and employment decisions. In this analysis, we assume that teenagers choose among four possible states of the world (dependent variable): in school but not employed (SNE), in school and employed (SE), not in school and employed (NSE), and not in school and not employed (NSNE). We assume that this choice is influenced by a set of state-level variables X, individual-level variables Z_k, and a person-specific random component ω_k. We also include dummy variables (J) for the individual's school/work activity in the previous year to account for individual heterogeneity or state dependence in the determination of this activity. The utility from each activity (indexed by j) for individual k in state i and period t is

$$(1) \qquad U_{kjit} = X_{it}\beta_j + Z_{kit}\gamma_j + J_{kit-1}\pi_j + \omega_{kit}$$

Assuming that ω_k has an extreme-value distribution, this specification leads to a multinomial logit model. Included in Z_k are dummy variables for age, race, gender, and urbanicity. Included in X are the state unemployment rate for males aged 25-64 years old, median state manufacturing wages, census division, and the effective minimum wage level lagged by one year.

We report the results for equation (1) after transforming the estimates into derivatives of the probability of each activity with respect to the minimum wage variable. Equation (1) can be expressed in general form as

$$(2) \qquad U_{kj} = W\alpha_j + \omega_k$$

with α normalized to zero for one of the activities. Then, the derivative of the probability of activity j with respect to the m^{th} element of W is calculated as

$$(3) \qquad \partial Pj / \partial W_m = P_j\{\alpha_{mj} - \sum_j (P_j \alpha_{mj})\}$$

where P_j is the probability of activity j, defined as

$$(4) \qquad P_j = \exp(W\alpha_j) / \{1 + \sum_j \exp(W\alpha_j)\}.$$

We compute standard errors of these derivatives based on a first-order Taylor series approximation of equation (3) around the true values of the α's (see Appendix A). We evaluate the derivatives and standard errors for a reference individual who is 17-years-old, non-Hispanic, white, faces a prime-aged male unemployment rate of 4 percent, and lives outside a central city in the northeastern division of the United States. Because we are interested in the effects of minimum wage hikes on transition among school/work activities, we evaluate these derivatives conditional on the initial activity. In particular, we calculate these probabilities by setting the dummy variable (i.e., the element of J) corresponding to the initial activity to one and the others to zero, in equation (4).

As the equation shows, in such calculations the effect of the minimum wage hikes on the probability of any particular transition is influenced by the level of the minimum wage variable.

We also estimate versions of equation (1) separately for various subgroups of teenagers; these models generate different effects of minimum wage hikes on employment and school enrollment transitions for the various subgroups. To test the theory that the disemployment effects of a higher minimum wage should be stronger for individuals initially paid below the proposed minimum wage, we estimate a model allowing separate minimum wage effects for these individuals. Thus, individuals whose wages were already too high to be directly affected by the increase in the minimum wage serve as a comparison group that controls for changes in the labor market that may have coincided with the increases in the minimum wage. These same models are performed separately by age, race, gender, and urbanicity to detect if the minimum wage increases have differential effects.

Empirical Results

We use both univariate and multivariate, multinomial logit models to estimate the effect of minimum wages on teens' employment and school enrollment transitions. The first model includes the minimum wage level as the primary independent variable and estimates the probabilities of employment and enrollment transitions at minimum wage levels of $5.15 and $6.15. The second model includes a dummy variable that indicates whether the employed teens are bound by the minimum wage increase, i.e., teenagers who are making between the prevailing minimum wage and the minimum wage the following year.[4] This model estimates the differential effects of a minimum wage increase on employed teenagers who are bound by the minimum wage hike compared to those employed teens making too much per hour to be directly affected. Finally, we include wage gap, the difference between the current minimum wage level and the wage rate of the teenager, as the primary independent variable in the multinomial logit model in order to estimate how the wage gap impacts teens' school enrollment and employment outcomes. We estimate the effect of minimum wage hikes on the overall teenage population as well as their differential effects on key subgroups of teenagers.

Table 3 compares employment and enrollment transitions among teenagers who have experienced a minimum wage hike and those who have not between 1991 and 1992. This univariate analysis suggests minimum wage hikes reduce transitions to employment by 3.1 percentage points for teens enrolled in school and increases the likelihood of becoming not employed by 1.3 percentage points for teens initially enrolled and employed. Moreover, teens who are initially idle, not enrolled and not employed, are 1.3 percentage points more likely to remain idle following a minimum wage hike compared to initially idle teens who did not face a minimum wage hike. In contrast, these results also suggest that minimum wage hikes slightly reduce the likelihood of transitioning to idleness for teens initially enrolled in school.

In order to isolate the effects of a minimum wage hike from other confounding factors, we estimate a multivariate multinomial logit model. Other independent variables in this model include lagged enrollment/employment status, age, race, gender, urbanicity, census division, state prime-aged male unemployment rate and state manufacturing wage. Table 4 simulates the effects of a minimum wage hike from $5.15 to $6.15 on the employment and school enrollment transitions of teenagers. A minimum wage hike of $1.00 has a statistically significant and qualitatively important affect on teens initially enrolled and not employed. For example, a $1 minimum wage hike is estimated to reduce transitions to employment by 3.6 percentage points but increase transitions to nonenrollment and employment by 17.2 percentage points for teens initially enrolled and not employed. A minimum wage hike significantly decreases the probability of becoming idle for all teens.[5] For example, teens initially idle are nearly 13 percentage points less likely to remain idle following a minimum wage hike. Our results suggest that an overwhelming proportion of teens who are initially idle remain not enrolled but become employed following a $1 minimum wage hike.

Table 5 compares school enrollment and employment transitions of teens who are initially employed following a minimum wage increase. These univariate analyses suggest that enrolled teens who initially had hourly wage rates below the new minimum wage (bound) are significantly more likely to remain enrolled compared to those who earn more than the new minimum wage (nonbound). Furthermore, employed teens not enrolled in school, who would be directly affected by a minimum wage increase, are significantly less likely to enroll in school the following year and are less likely to remain employed than nonbound teens.

When we control for other explanatory factors, transition probabilities of bound and nonbound teenagers change both in sign and in significance, revealing the isolated effect of a minimum wage hike on teens' employment and enrollment decisions (Table 6). Teens who earn less than the new minimum wage and who are initially enrolled are more likely to become not employed and/or not enrolled in school and are less likely to remain employed and enrolled compared to nonbound teens even though the estimates are statistically insignificant. On the other hand, an increase in minimum wage leads to statistically significant differences between bound and nonbound teens who are initially not enrolled and employed. In this category, teens who are bound by the new minimum wage are less likely to return to school either employed or nonemployed relative to nonbound teens. Instead they have a higher probability of remaining not enrolled and employed or becoming idle compared to nonbound teens.

Teens' hourly wage rates relative to the new minimum wage also have an impact on their school enrollment and employment decisions. As shown in Figure 1, among teens who are initially not enrolled and employed, the likelihood of becoming idle rises and that of remaining not enrolled and employed falls as teens' hourly wage rate fall below the new minimum wage. The results for teens who are initially enrolled and employed are consistent with Neumark and Wascher's findings. As the hourly wage rate of a teenager falls, his likelihood of remaining enrolled and employed rises and the probability of his becoming enrolled and not employed falls.

We also investigate the differential effects of the minimum wage increase on subgroups by age, gender, race and urbanicity. A comparison of the changes in school and work outcomes of 16-17 year-olds to those of 18-19 year-olds in response to a minimum wage reveal some significant differences between these two groups (Table 7). For example, 16-17 year-olds who are initially enrolled and not employed are more likely to take on a job while in school following a minimum wage increase whereas 18-19 year-olds in the same situation become less likely to do so. A minimum wage hike increases the likelihood of employment among 18-19 year-olds regardless of their initial status while it has a negative and statistically insignificant effect on employment among enrolled 16-17 year-olds. As a result of a minimum wage hike, younger teens who are initially not enrolled and employed are 12.1 percentage points more likely to continue their education while working whereas corresponding older teens become less likely to do so. Moreover, our results suggest that an increase in minimum wage decreases the probability of becoming idle for both age groups.

Differential analysis also reveals differences in the way that black and Hispanic, and nonblack, non-Hispanic teens would be affected by the proposed minimum wage increase (Table 8). Our findings suggest that black and Hispanic teens who are not initially idle are more likely to become idle following a minimum wage increase while nonblack, non-Hispanic teens become less likely to shift to the not enrolled and not employed status. For example, black and Hispanic teens initially enrolled and employed are 33.7 percentage points more likely to become idle following a $1 minimum wage increase. In addition, our results suggest that while black and Hispanic teens move out of employment and enrollment into idleness, nonblack, non-Hispanic teens become more likely to become employed.

In contrast to the differences in reactions of teens from different age and race subgroups to a minimum wage increase, teens across genders behave quite similarly in response to a minimum wage hike (Table 9). The most significant difference between school and work transitions of male and female teenagers comes up among those who are initially enrolled but not employed. Female teenagers in this category become less likely to be enrolled and employed after a minimum wage increase while their male counterparts become significantly more likely to start working while in school.

A comparison of teens who live in central cities and those who live outside central cities reveals several differences in their employment and school enrollment transitions in response to a minimum wage increase (Table 10). The general trend among teens living outside central city is to transition out of school enrollment and into work following a minimum wage increase. On the other hand, minimum wage increases appear to have different, but statistically insignificant, effects on teens living in central city. Those who are initially not employed become more likely to shift into idleness while those who are initially employed tend to return to (or remain in) school or become idle. In general, higher minimum wages are estimated to reduce the likelihood of becoming idle for teens outside central cities regardless of their initial enrollment/employment status.

Conclusion

The recent proposal to increase the federal minimum wage from $5.15 to $6.15 per hour has opened a new debate among scholars and policymakers. We believe that the effects of minimum wage on school and work decisions of teens should play a more central role in this debate, which has traditionally focused disproportionately on employment effects. To this end, in this paper, we examine the impact of the proposed minimum wage increase on teens' school enrollment and employment. Our main findings can be summarized as follows:

Overall Effects:

- Teen employment appears to increase as a result of a minimum wage increase.
- A minimum wage increase appears to decrease the probability of becoming idle.
- The likelihood of becoming idle falls as employed teens' hourly wages increase.

- Among employed teens who are initially not enrolled in school, those directly affected by the minimum wage increase are less likely to return to school compared to those not directly affected following a minimum wage increase.

Differential Effects:

- Black and Hispanic teens who are initially idle are more likely to remain idle, while nonblack, non-Hispanic teens become less likely to do so following a minimum wage increase.
- A higher minimum wage is estimated to reduce the likelihood of becoming idle for teens outside central cities while it has a qualitatively large positive but statistically insignificant effect on the likelihood of becoming idle for teens living in central cities.
- Female teenagers who are initially enrolled are more likely to leave school, while male teenagers are more likely to start working as a result of a minimum wage increase.
- Higher minimum wages prompt younger teens to continue their education while older teens are significantly more likely to leave school.

Our findings suggest that an increase in minimum wage has significant consequences on the educational attainment and labor market activities of teens. Our initial results suggest that higher minimum wages reduce the probability of idleness among teens regardless of their initial status. However, upon more careful analysis we find that black and Hispanic teens and teens in central city are more likely to become idle, not-enrolled and not-employed, as a result of a minimum wage increase.

This study's findings are consistent with earlier findings in highlighting the detrimental effect higher minimum wages have on potentially vulnerable groups of the teenage population—black and Hispanics, and those living in central cities. More research is needed to identify why some teens apparently benefit from minimum wage hikes while other groups suffer. Nonetheless, this study, in combination with earlier studies, should make proponents of a higher minimum wage think twice.

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Table 1. State and Federal Minimum Wage Levels in 1990 and 1991

Year[1]	States with Minimum Wages Exceeding Federal Minimum[2]	# of States with State Minimum Wage Increases[3]	Federal Minimum
1990	AK (3.85), CA (4.25), CT (4.25), DC (4.85), HI (3.85), IA (3.85), ME (3.85), MA (3.75), MN (3.95), NH (3.75), ND (3.40), OR (4.25), PA (3.70), RI (4.25), VT (3.75), WA (4.25), WI (3.65)	12	$3.35
1991	AK (4.30), CA (4.25), CT (4.25), DC (5.45), HI (3.85), IA (4.25), ME (3.85), MN (4.25), MT (4.25), NH (3.85), OR (4.75), RI (4.25), VT (3.85), WA (4.25)	8	$3.80

Source: The Council of State Governments, *Book of States*. Vol. 27-29, Lexington, KY; U.S. Department of Labor, Bureau of Labor Statistics, *Monthly Labor Review*, January 1990-January 1992.

Note: [1]January in the given year.
[2]Alaska (AK), California (CA), Connecticut (CT), District of Columbia (DC), Hawaii (HI), Iowa (IA), Maine (ME), Massachusetts (MA), Minnesota (MN), Montana (MT), New Hampshire (NH), New Jersey (NJ), Oregon (OR), Rhode Island (RI), Vermont (VT), Washington (WA).
[3]States identified to increase their minimum wages met two conditions: (1) the state minimum wage (SMW) increased, SMW(t)>SMW(t-1), and (2) the new state minimum wage was higher than the federal minimum wage (FMW), SMW(t)>FMW(t).

Table 2. Summary Statistics

Variable Name	Definition	Mean and (Std. Deviation)
Enrolled & Not Employed, t=1	1 if enrolled in school and not employed, 0 otherwise	0.476 (0.499)
Enrolled & Employed, t=1	1 if enrolled in school and employed, 0 otherwise	0.326 (0.469)
Not Enrolled & Employed, t=1	1 if not enrolled in school and employed, 0 otherwise	0.106 (0.308)
Not Enrolled & Not Employed, t=1	1 if not enrolled in school and not employed, 0 otherwise	0.092 (0.289)
Enrolled & Not Employed, t=2	1 if enrolled in school and not employed, 0 otherwise	0.398 (0.490)
Enrolled & Employed, t=2	1 if enrolled in school and employed, 0 otherwise	0.296 (0.457)
Not Enrolled & Employed, t=2	1 if not enrolled in school and employed, 0 otherwise	0.189 (0.391)
Not Enrolled & Not Employed, t=2	1 if not enrolled in school and not employed, 0 otherwise	0.117 (0.321)
Lagged Effective Minimum Wage	Maximum of federal and state minimum wages, lagged by twelve months	3.900 (0.207)
Bound	1 if wage less than the new minimum wage but no less than the old minimum in the base year, 0 otherwise [defined for respondents employed in base year]	0.717 (0.451)
Wage Gap	If Bound=1 then effective minimum wage in year t minus the individual=s wage rate in year t-1, 0 otherwise [defined for respondents employed in base year]	-0.651 (2.844)

Table 3. Employment and School Enrollment Transitions Based on Minimum Wage Increases[6]

Minimum Wage Increase

Year 2	*Year 1* Enrolled & Not Employed	Enrolled & Employed	Not Enrolled & Employed	Not Enrolled & Not Employed
Enrolled & Not Employed	0.295	0.075	0.006	0.013
Enrolled & Employed	0.093	0.191	0.012	0.004
Not Enrolled & Employed	0.037	0.062	0.080	0.018
Not Enrolled & Not Employed	0.033	0.013	0.019	0.052
No. of Observations	1185	883	303	226

No Minimum Wage Hike

Year 2	*Year 1* Enrolled & Not Employed	Enrolled & Employed	Not Enrolled & Employed	Not Enrolled & Not Employed
Enrolled & Not Employed	0.306	0.062	0.006	0.011
Enrolled & Employed	0.123	0.171	0.013	0.004
Not Enrolled & Employed	0.043	0.057	0.075	0.021
Not Enrolled & Not Employed	0.041	0.012	0.016	0.039
No. of Observations	1546	910	332	226

Difference (Hike - No Hike)

Year 2	***Year 1*** Enrolled & Not Employed	Enrolled & Employed	Not Enrolled & Employed	Not Enrolled & Not Employed
Enrolled & Not Employed	-0.011	0.013*	0.000	0.002
Enrolled & Employed	-0.031*	0.020^	-0.001	-0.001
Not Enrolled & Employed	-0.007	0.005	0.004	-0.003
Not Enrolled & Not Employed	-0.008¯	0.000	0.003	0.013*

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Statistical significance is evaluated using the following statistic:

$t = (x - y) / \sqrt{S_x^{\ 2} / n_x + s_y^{\ 2} / n_y}$ where x and y are the sample means.

(Table Continued)

Table 4. Effects of a Minimum Wage Increase on Employment and School Enrollment Transitions

	$5.15 Minimum Wage			
	Year 1			
Year 2	Enrolled & Not Employed	Enrolled & Employed	Not Enrolled & Employed	Not Enrolled & Not Employed
Enrolled & Not Employed	0.446	0.111	0.022	0.128
Enrolled & Employed	0.282	0.583	0.083	0.052
Not Enrolled & Employed	0.224	0.293	0.847	0.515
Not Enrolled & Not Employed	0.048	0.013	0.048	0.306

	$6.15 Minimum Wage			
	Year 1			
Year 2	Enrolled & Not Employed	Enrolled & Employed	Not Enrolled & Employed	Not Enrolled & Not Employed
Enrolled & Not Employed	0.323	0.072	0.010	0.073
Enrolled & Employed	0.246	0.455	0.045	0.035
Not Enrolled & Employed	0.396	0.464	0.924	0.714
Not Enrolled & Not Employed	0.036	0.009	0.022	0.178

Difference ($6.15 - $5.15)

	Year 1			
Year 2	Enrolled & Not Employed	Enrolled & Employed	Not Enrolled & Employed	Not Enrolled & Not Employed
Enrolled & Not Employed	-0.123*	-0.039	-0.012	-0.055
	(0.008)	(5.587)	(0.386)	(0.410)
Enrolled & Employed	-0.036*	-0.128	-0.038	-0.016
	(0.017)	(0.223)	(0.110)	(0.656)
Not Enrolled & Employed	0.172*	0.171	0.077*	0.199*
	(0.011)	(0.353)	(0.001)	(0.066)
Not Enrolled & Not Employed	-0.012*	-0.004	-0.026*	-0.128*
	(0.002)	(0.064)	(0.001)	(0.045)

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Independent variables include for lagged enrollment/employment status, age, race, gender, urbanicity, census division, state prime-aged male unemployment rate, state manufacturing wage, and the effective minimum wage.

Estimates are based on a reference individual who was enrolled and not employed during the previous school year, 17 years old, nonhispanic white, male, living outside central city in the Northeast, with average state unemployment and manufacturing wages.

(Table Continued)

Table 5. School Enrollment and Employment Transitions Based on Initial Wages[7]

	Bound		Nonbound		Difference (Bound – Nonbound)	
	Year 1		***Year 1***		***Year 1***	
Year 2	Enrolled & Employed	Not Enrolled & Employed	Enrolled & Employed	Not Enrolled & Employed	Enrolled & Employed	Not Enrolled & Employed
Enrolled & Not Employed	0.201	0.013	0.128	0.012	0.073*	0.001
Enrolled & Employed	0.462	0.015	0.373	0.036	0.089*	-0.021*
Not Enrolled & Employed	0.114	0.126	0.158	0.222	-0.045*	-0.096*
Not Enrolled & Not Employed	0.030	0.038	0.026	0.044	0.004	-0.006
No. of Observations	426	102	368	169	-	-

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Definitions:

Bound = employed teen's hourly wage rate is less than the new minimum wage.
Nonbound = employed teen's hourly wage rate is equal or greater than the new minimum wage.

Table 6. Effects of a Minimum Wage Increase on School Enrollment and Employment Transitions Based on Initial Wages

	Bound *Year 1*		**Nonbound** *Year 1*		**Difference (Bound – Nonbound)** *Year 1*	
Year 2	Enrolled & Employed	Not Enrolled & Employed	Enrolled & Employed	Not Enrolled & Employed	Enrolled & Employed	Not Enrolled & Employed
Enrolled & Not Employed	0.175	0.052	0.165	0.059	0.013 (0.764)	-0.007* (0.003)
Enrolled & Employed	0.623	0.122	0.677	0.160	-0.054 (0.309)	-0.038* (0.000)
Not Enrolled & Employed	0.173	0.701	0.135	0.663	0.038 (0.031)	0.038* (0.003)
Not Enrolled & Not Employed	0.029	0.126	0.023	0.118	0.006 (0.150)	0.008* (0.001)

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Independent variables include for lagged enrollment/employment status, age, race, gender, urbanicity, census division, state prime-aged male unemployment rate, state manufacturing wage, and the effective minimum wage.

Estimates are based on a reference individual who was enrolled and not employed during the previous school year, 17 years old, nonhispanic white, male, living outside central city in the Northeast, with average state unemployment and manufacturing wages.

Table 7. Effects of a Minimum Wage Increase on Transition Probabilities Disaggregated by Age
Entries are differences between predicted probabilities at $6.15 and $5.15 minimum wage levels ($6.15-$5.15). Standard errors are in parentheses.

16-17 Year-Olds

	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.162* (0.019)	-0.033 (56.323)	-0.061 (0.455)	-0.080 (0.739)
SE	0.180* (0.002)	0.035 (0.102)	0.121* (0.013)	0.215 (0.548)
NSE	-3.13E-06 (2.763)	-2.68E-06 (19072.49)	-3.82E-05 (2.759)	-3.08E-06 (2.764)
NSNE	-0.018* (0.001)	-0.002 (0.035)	-0.135* (0.004)	-0.135 (0.153)

18-19 Year-Olds

	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.131* (0.027)	-0.050 (0.644)	-0.006 (1.090)	-0.033 (1.111)
SE	-0.057 (0.440)	-0.137 (0.685)	-0.011 (1.208)	-0.008 (1.744)
NSE	0.191* (0.022)	0.192* (0.016)	0.034* (0.002)	0.120 (0.131)
NSNE	-0.003 (0.004)	-0.006 (0.005)	-0.016* (0.001)	-0.079 (0.070)

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Independent variables include for lagged enrollment/employment status, age, race, gender, urbanicity, census division, state prime-aged male unemployment rate, state manufacturing wage, and the effective minimum wage.
Estimates are based on a reference individual who was enrolled and not employed during the previous school year, 17 years old, nonhispanic white, male, living outside central city in the Northeast, with average state unemployment and manufacturing wages.

Table 8. Effects of a Minimum Wage Increase on Transition Probabilities Disaggregated by Race
Entries are differences between predicted probabilities at $6.15 and $5.15 minimum wage levels ($6.15-$5.15). Standard errors are in parentheses.

Black and Hispanic				
	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.300 (0.744)	-0.273 (0.867)	-0.068 (2.927)	-0.086 (3.085)
SE	6.723E-06 (11.338)	6.384E-05 (11.339)	-9.5E-07 (11.339)	-1.726E-06 (11.340)
NSE	-0.024 (7.477)	-0.064 (6.533)	-0.251 (5.359)	-0.027 (7.936)
NSNE	0.324* (0.133)	0.337* (0.148)	0.319 (0.400)	-0.113 (0.751)

Nonblack, Non-Hispanic				
	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.133* (0.006)	-0.037 (11.415)	-0.011 (0.564)	-0.055 (0.630)
SE	-0.028* (0.006)	-0.122 (0.199)	-0.045 (0.074)	-0.014 (0.918)
NSE	0.172* (0.006)	0.163 (0.396)	0.079* (0.001)	0.205* (0.055)
NSNE	-0.011* (0.001)	-0.003 (0.046)	-0.023* (3.902E-04)	-0.136* (0.027)

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Independent variables include for lagged enrollment/employment status, age, race, gender, urbanicity, census division, state prime-aged male unemployment rate, state manufacturing wage, and the effective minimum wage.
Estimates are based on a reference individual who was enrolled and not employed during the previous school year, 17 years old, nonhispanic white, male, living outside central city in the Northeast, with average state unemployment and manufacturing wages.

Table 9. Effects of a Minimum Wage Increase on Transition Probabilities Disaggregated by Gender

Entries are differences between predicted probabilities at $6.15 and $5.15 minimum wage levels ($6.15-$5.15). Standard errors are in parentheses.

Female

	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.106* (0.014)	-0.057 (1.218)	-0.013 (0.941)	-0.079 (0.783)
SE	-0.103 (0.138)	-0.266 (0.634)	-0.041 (0.714)	-0.019 (1.756)
NSE	0.212* (0.051)	0.326^ (0.178)	0.089* (0.004)	0.234 (0.186)
NSNE	-0.004 (0.003)	-0.003 (0.025)	-0.035* (0.001)	-0.136* (0.061)

Male

	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.123* (0.013)	-0.025 (85.173)	-0.013 (0.704)	-0.038 (0.941)
SE	0.089* (0.005)	0.018 (0.348)	0.001 (0.040)	0.031 (0.803)
NSE	0.053* (0.017)	0.012 (5.486)	0.039* (0.002)	0.154 (0.160)
NSNE	-0.019* (0.001)	-0.005 (0.097)	-0.028* (0.001)	-0.147* (0.040)

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Independent variables include for lagged enrollment/employment status, age, race, gender, urbanicity, census division, state prime-aged male unemployment rate, state manufacturing wage, and the effective minimum wage. Estimates are based on a reference individual who was enrolled and not employed during the previous school year, 17 years old, nonhispanic white, male, living outside central city in the Northeast, with average state unemployment and manufacturing wages.

Table 10. Effects of a Minimum Wage Increase on Transition Probabilities Disaggregated by Urbanicity
Entries are differences between predicted probabilities at $6.15 and $5.15 minimum wage levels ($6.15-$5.15). Standard errors are in parentheses.

Central City

	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.047 (0.438)	0.098 (2.507)	0.011 (2.291)	-0.004 (3.161)
SE	-0.042 (2.972)	-0.179 (3.377)	-0.035 (3.365)	-0.015 (4.029)
NSE	-0.014 (4.497)	-0.052 (18.429)	-0.259 (2.555)	-0.009 (4.748)
NSNE	0.104 (0.106)	0.134 (0.268)	0.284 (0.279)	0.028 (0.892)

Outside Central City

	Year 1			
Year 2	SNE	SE	NSE	NSNE
SNE	-0.212* (0.006)	-0.051 (13.237)	-0.009 (0.548)	-0.063 (0.475)
SE	-0.143* (0.006)	-0.277 (0.245)	-0.043 (0.060)	-0.024 (0.803)
NSE	0.365* (0.001)	0.331* (0.056)	0.063* (8.540E-05)	0.156* (0.004)
NSNE	-0.011* (1.411E-04)	-0.003 (0.013)	-0.011* (2.631E-05)	-0.068* (0.001)

* Statistically significant at the 5 percent level.
^ Statistically significant at the 10 percent level.
¯ Statistically significant at the 15 percent level.

Independent variables include for lagged enrollment/employment status, age, race, gender, urbanicity, census division, state prime-aged male unemployment rate, state manufacturing wage, and the effective minimum wage.
Estimates are based on a reference individual who was enrolled and not employed during the previous school year, 17 years old, nonhispanic white, male, living outside central city in the Northeast, with average state unemployment and manufacturing wages.

Figure 1a. Effects of A Wage Gap on School Enrollment and Employment Decisions of Teens Initially Not Enrolled/Employed

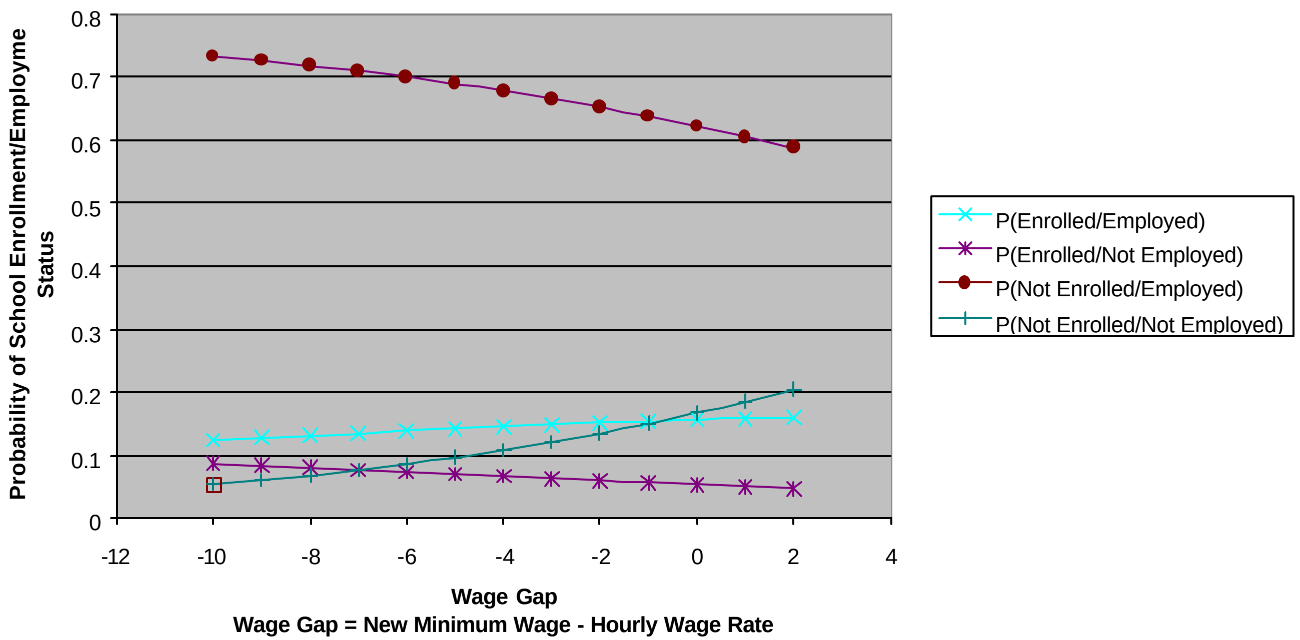
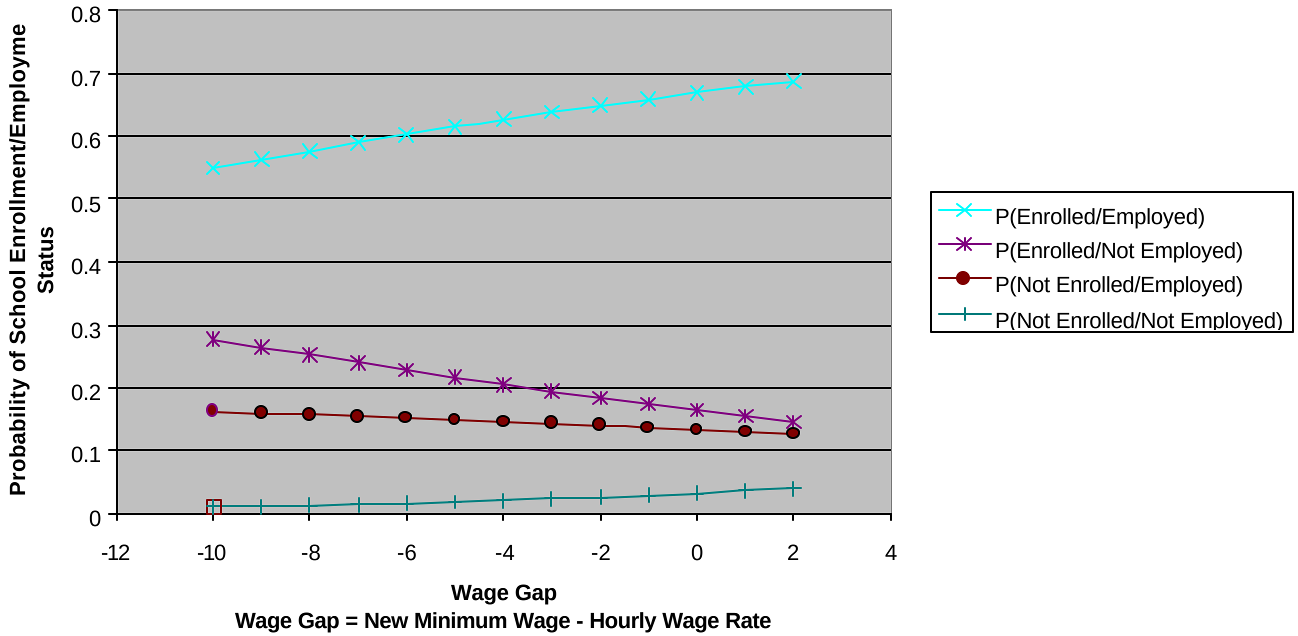


Figure 1b. Effects of A Wage Gap on School Enrollment and Employment Decisions of Teens Initially Enrolled/Employed



Appendix A: Calculating the Statistical Significance of the Difference Between Two Probabilities

Most of the tables included in this paper involve calculating the statistical significance of the difference between predicted probabilities when varying one independent variable and holding everything else constant. We base our statistical test on $(P^2 - P^1)/\sqrt{V(P^2 - P^1)}$, where P^1 and P^2 refer to the probabilities predicted at two different levels of an independent variable. While the numerator of this test statistic is merely the difference between two predicted probabilities when varying one independent variable, the standard error in the denominator requires further calculation.

Probabilities are calculated as

(1) $$P_k^{\,1} = e^{aL_k^{\,1} + bX_{ki} + e_{ik}} \,/(1 + \sum_j e^{aLj^1 + bX_{ij} + e_{ij}})$$ and

(2) $$P_k^{\,2} = e^{aL_k^{\,2} + bX_{ki} + e_{ik}} \,/(1 + \sum_j e^{aL_j^{\,2} + bX_{ij} + e_{ij}})$$

where L^1 and L^2 are the two levels of the independent variable and X is the matrix of other independent variables which are held constant in predicting probabilities.

Without other control variables, P^2-P^1 has the mean, P^2-P^1, and variance

(3) $$V(P^2 - P^1 \mid no\, controls) = (1 - P^2)/N^2 + (1 - P^1)/N^1$$

Assuming that the ratio of the variances of (P^2-P^1) with and without controls is equal to the ratio of the coefficient estimate, α with and without controls, the variance of (P^2-P^1) with control variables is the following:

(4) $$V(P^2 - P^1 \mid controls) = V(P^2 - P_1) \mid no\, controls) * \frac{V(a \mid controls)}{V(a \mid no\, controls)}$$

where

(5) $$V(a \mid no\, controls) = (1 - P^1)/N^1(1 - \Sigma_k P^1) + (1 - P^2)/N^2(1 - \Sigma_k P^2)$$

and k is the number of outcomes for the dependent variable.

The above assumption allows us to simplify the calculation of V(P^2-P^1|controls) which would be computationally difficult.

Appendix B. Variable Definitions and Summary Statistics

Variable Name	Definition	Mean and (Std. Dev.)
	School Enrollment and Employment Status$_t$	
Enrolled & Not Employed (SNE_t)	1 if enrolled in school and not employed at time t, 0 otherwise	0.476 (0.499)
Enrolled & Employed (SE_t)	1 if enrolled in school and employed at time t, 0 otherwise	0.326 (0.469)
Not Enrolled & Employed (NSE_t)	1 if not enrolled in school and employed at time t, 0 otherwise	0.106 (0.308)
Not Enrolled & Not Employed ($NSNE_t$)	1 if not enrolled in school and not employed at time t, 0 otherwise	0.092 (0.289)
	School Enrollment and Employment Status$_{t+1}$	
Enrolled & Not Employed (SNE_{t+1})	1 if enrolled in school and not employed at time t+1, 0 otherwise	0.398 (0.490)
Enrolled & Employed (SE_{t+1})	1 if enrolled in school and employed at time t+1, 0 otherwise	0.296 (0.457)
Not Enrolled & Employed (NSE_{t+1})	1 if not enrolled in school and employed at time t+1, 0 otherwise	0.189 (0.391)
Not Enrolled & Not Employed ($NSNE_{t+1}$)	1 if not enrolled in school and not employed at time t+1, 0 otherwise	0.117 (0.321)
	Local Labor Market Conditions	
Effective Minimum Wage	Maximum of the federal minimum wage and the state minimum wage	3.900 (0.207)
Bound	1 if hourly wage rate is less than the effective minimum wage$_{t+1}$, 0 otherwise [defined for respondents employed in base year]	0.717 (0.451)
Wage Gap	Hourly wage rate$_t$ minus the effective minimum wage$_{t+1}$ [defined for respondents employed in base year]	-0.651 (2.844)
Average State Wage	Average real state wage (January 1990 base)	8.389 (0.828)
State Prime-Age Male Unemployment Rate	Average monthly state unemployment rate for male 25 to 65-years-old	0.047 (0.015)

Central City	1 if live in a central city, 0 otherwise	0.277 (0.448)
Northeastern[1]	1 if in Northeastern U.S., 0 otherwise	0.046 (0.208)
Mid-Atlantic [1]	1 if in Mid-Atlantic U.S., 0 otherwise	0.172 (0.378)
Northeastern Central[1]	1 if in Northeastern Central U.S., 0 otherwise	0.161 (0.368)
Northwestern Central[1]	1 if in Northwestern Central U.S., 0 otherwise	0.072 (0.258)
South Atlantic [1]	1 if in South Atlantic U.S., 0 otherwise	0.177 (0.381)
Southeastern Central[1]	1 if in Southeastern Central U.S., 0 otherwise	0.067 (0.250)
Southwestern Central[1]	1 if in Southwestern Central U.S., 0 otherwise	0.115 (0.319)
Mountain[1]	1 if in Mountain U.S., 0 otherwise	0.039 (0.193)
	Demographic Characteristics	
17 years old [2]	1 if 17 years old, 0 otherwise	0.240 (0.427)
18 years old [2]	1 if 18 years old, 0 otherwise	0.260 (0.438)
19 years old [2]	1 if 18 years old, 0 otherwise	0.250 (0.433)
African-American[3]	1 if non-Hispanic black, 0 otherwise	0.140 (0.347)
Hispanic [3]	1 if Hispanic, 0 otherwise	0.107 (0.310)
Female	1 if female, 0 otherwise	0.494 (0.500)

[1]The reference category is the Pacific census division.
[2]The reference category is 16 years old.
[3]The reference category is white, non-Hispanic.

Appendix C. Frequency Distributions Based on Initial and Final School Enrollment and Employment Status

	SNE_t	SE_t	NSE_t	$NSNE_t$	SNE_{t+1}	SE_{t+1}	NSE_{t+1}	$NSNE_{t+1}$
Gender								
Female	0.454	0.338	0.106	0.102	0.380	0.326	0.170	0.125
Male	0.498	0.314	0.107	0.082	0.417	0.267	0.207	0.109
Race								
Black and Hispanic	0.556	0.229	0.084	0.131	0.485	0.193	0.149	0.173
Nonblack and Non-Hispanic	0.449	0.358	0.114	0.079	0.370	0.330	0.202	0.098
Age Group								
16-17 Year-olds	0.612	0.333	0.016	0.039	0.501	0.347	0.073	0.080
18-19 Year-olds	0.345	0.319	0.193	0.143	0.300	0.247	0.300	0.153
Urbanicity								
Central City	0.534	0.267	0.092	0.107	0.432	0.258	0.181	0.128
Noncentral City	0.454	0.348	0.112	0.086	0.386	0.311	0.192	0.112

Endnotes

[1] In addition, most states' child labor laws restrict or prohibit employment for teens less than 16 years old.

[2] In a simple model of monopsony, there exists a range in which an increased minimum wage leads to an increase in employment. This result follows from the fact that with a higher minimum wage, the monopsonist maximizes profits by hiring more workers whose marginal revenue product exceeds the minimum wage.

[3] Respondents are interviewed every four months, and they answer questions about activity during the previous four months. Each respondent is interviewed eight times, generating 32 months of data. The SIPP uses a rotating, staggered interview design whereby one fourth of the sample is interviewed each month.

[4] Because we are using data from the early 1990s, employed teens wages are compared to the contemporaneous effective minimum wages in their state of residence.

[5] Statistically significant in three of the four categories.

[6] These crosstabulations are based on both 88-89 and 91-92 panels.

[7] These crosstabulations are based on both 88-89 and 91-92 panels.