

**THE ANSWER TO THE US MINIMUM WAGE PUZZLE?  
ONLY FEDERAL MINIMUM WAGE HIKES HAVE A NEGATIVE EFFECT ON  
TEENAGE EMPLOYMENT**

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*Abstract*

The ‘new economics of the minimum wage’ is based on the finding from a number of case studies in the United States that minimum wages had no effect on employment and may even have increased it. This conclusion is at odds with the findings of earlier studies and of a number of more recent studies which find a statistically significant negative effect on teenage employment. How different studies can find such contrasting results constitutes a puzzle. Using data from the Current Population Survey and building upon recent research using state-level data, we show that by and large minimum wage hikes implemented at the state-level had no negative effects on teenage employment during the 1980s and 1990s, while the federal minimum wage hikes on 1990-91 and 1996-97 did. Since the new economics of the minimum wage is based on the analysis of a number of state-specific hikes, our results enable the different findings to be reconciled.

*Key words:* Federal Minimum Wages, State Minimum Wages, Teenage Employment

*JEL Codes:* J23, J38

## Introduction

The 'new economics of the minimum wage' is based on a number of studies which showed that during the 1980s and 1990s, minimum wage increases had no significant effects on the employment of those most affected and sometimes were even found to have positive employment effects (Card and Krueger, 1994, 1995, 2000). These findings generated and continue to generate a good deal of debate<sup>1</sup> for a number of reasons. Firstly, they are at odds with the predictions of orthodox economic theory, that in a competitive market a binding price increase would lead to a reduction in demand. While the idea of monopsony in the labor market has gained a certain degree of support (see for example Manning, 2003) many labor economists are unconvinced that it is appropriate for the analysis of low-wage labor markets. Secondly, the results presented by Card and Krueger (1995) are in stark contrast to those obtained in the large number of studies that underpinned the consensus which emerged in the early 1980s, according to which minimum wage hikes had a small but statistically significant negative impact on teenage employment (Brown et al., 1982, 1983).

This debate has been rekindled by the findings of a number of recent studies, undertaken in the light of Card and Krueger's research, which identify negative effects of minimum wage hikes on the employment of teenagers. For example, using long time series, both Williams and Smith (2001) and Bazen and Marimoutou (2002) find negative and statistically significant effects of federal minimum wages. While Card and Krueger (1995, Chapter 7) using data from the Current Population Survey (CPS) for a cross section of states find no significant employment effect due to state or federal minimum wages, Burkhauser et al. (2000) show that this is due to the presence of time dummies that annihilate the effect of the federal minimum wage. Furthermore, using pooled time series data on states from the CPS, Burkhauser et al. find consistently negative effects of both state and federal minimum wages on teenage employment<sup>2</sup>. Card (1992) using state-level data finds no evidence of a significant employment impact of the 1990 federal minimum wage hike, while Deare et al. (1995) find that the 1990 and 1991 federal increases reduce teenage employment. Thus there is a puzzle: how can different studies find such conflicting results? Put differently, did the minimum wage increases implemented in the United States during the last twenty years really have no adverse effects on teenage employment?

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<sup>1</sup> See for example the review article by John Kennan (1996) and David Neumark and William Wascher's (2000) re-working of the original 1994 Card and Krueger study.

<sup>2</sup> Neumark and Wascher (1994) also find negative employment effects but their model specification has been criticised for including the teenage school enrolment rate as an explanatory variable - see for example, Card and Krueger (1995).

In this paper we show that there were in general no significant negative employment effects for teenagers associated with state-level minimum wages. The federal minimum wage hikes implemented in the early and mid 1990s on the other hand did have a negative impact on teenage employment. This dichotomy provides an explanation of the puzzle mentioned above. Different studies find different results according to the type of minimum wage hike studied and the new economics of the minimum wage in the United States is founded essentially on the analysis of specific state-level hikes.

We proceed by first describing the state-level minimum wage increases that were implemented during the 1980s and 1990s in section 1. We then present a descriptive analysis of the CPS state-level data that we use in section 2. In the following section, we present estimates of the impact of state-level minimum wage hikes on teenage employment-population ratios for the period up to 1989 using the same model specification as Burkhauser et al. (2000). In section 4 we use the same approach to examine the employment impact of the federal hikes implemented in the 1990s. In section 5 we propose three possible explanations for our findings.

## **I. State-level and federal minimum wage increases**

The federal minimum wage was frozen at \$3.35 from when it was implemented in 1981 until 1990, and was increased by 13.4% in April 1990 to \$3.80. However, thirteen states implemented increases in their own legal minimum rates in between these federal minimum wage hikes. Furthermore, most of these states implemented more than one increase during the period. We exclude from our analysis the District of Columbia which from the outset of the period studied had a minimum wage above the federal rate, and which implemented annual increases up to 1988 and froze its minimum at \$4.33 from 1988 to 1993. We also exclude the two non-contiguous states Alaska and Hawaii. Thus our study examines the consequences of the twenty-six increases enacted in eleven different states between 1982 and 1989. It is interesting to note that nineteen of these hikes were implemented in six states in the New England division. By January 1<sup>st</sup> 1990, six of these states already had a minimum wage at or above the value of the 1990 federal minimum of \$3.80. There was a further hike in the federal minimum wage in April 1991 to \$4.25, and seven states already had minima at or above this rate in January 1991.

The federal minimum remained unchanged from 1991 to 1995 and was increased in October 1996 to \$4.75. In the intervening period 1992-5, four states increased their minimum wage rates and by January 1<sup>st</sup> 1996, three already had rates higher than \$4.75. A further increase in the latter to \$5.15 was implemented in October 1997 and this affected all but three of the included states<sup>3</sup> (since we have excluded from the outset the District of Columbia and the two non contiguous states). Figure A.1 in the appendix displays the state-level increases that took place over the period 1984-1995 other than those that occurred in the years where there were federal hikes.

## II. Data

We are interested in how state teenage employment levels change in relation to the minimum wage, and like many previous studies we use the Current Population Survey Merged Outgoing Rotation Groups. These data are constructed from the monthly CPS returns and only respondents in their fourth or eighth month in the survey are included. We use annualized data for the years 1984 to 1998, corresponding to the minimum wage hikes described above. Descriptive statistics show that teenage employment-population ratios vary enormously between states – from a minimum of 25% to a maximum of nearly 65%. What we are interested in here is how the ratio varies over time for states affected by minimum wage hikes. Table 1 provides means and standard deviations of the key variables used in this paper. It can be seen that during periods when there are no federal minimum wage increases, the teenage employment-population ratio rises and it falls in the years when there are hikes. In fact the ratio is roughly the same in 1984 and in 1997, despite having risen by around 4 points when the federal minimum remained unchanged for a long period. The prime-age male unemployment rate declines substantially over the period studied while average nominal earnings increase.

Figures 1 and 2 display the evolution of teenage employment by states over the periods 1985-1989 and 1992-1995 respectively. The states that implemented increases in their own legal minimum rates between the federal minimum hikes are drawn in light grey, and it is clear that in most of these, teenage employment increased between 1985 and 1989, with the exception of Connecticut, New Hampshire and Massachusetts. In the period 1992-1995, there were only

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<sup>3</sup> On January 1<sup>st</sup> 1997 the state minimum was raised above \$5.15 in Massachusetts (to \$5.25) and Oregon (to \$5.50), and in California (to \$5.50) in March 1997.

four state-level increases and in each of the states concerned, the teenage employment population ratio increased. Nevertheless, we have to compare these changes relative to what happened in other states and to take into account other influences on teenage employment.

### III. The impact of state minimum wage hikes 1984-9

In order to test the hypothesis that minimum wage hikes have no effect on teenage employment, we adopt the same underlying specification as Burkhauser et al. (2001) who estimate an equation of the form with pooled state data:

$$E_{st} = \phi_s + \phi_1 U_{st} + \phi_2 P_{st} + \phi_3 w_{st} + \theta m_{st} + v_{st}$$

where  $v_{st}$  is the error term,  $s$  refers to the state and  $t$  to a month/year.  $E$  is the teenage employment-population ratio,  $U$  is the rate of unemployment among prime-age males,  $w$  is the logarithm of average usual earnings of adult workers and  $m$  is the logarithm of the prevailing minimum wage – the higher of the state or federal minima. The equation is estimated with state fixed effects  $\phi_s$ . We estimate this equation using annualized state data by eliminating the fixed effect by taking first (time) differences:

$$\Delta E_{st} = \phi_1 \Delta U_{st} + \phi_2 \Delta P_{st} + \phi_3 \Delta w_{st} + \theta \Delta m_{st} + \Delta v_{st} \quad (1)$$

The first difference transformation is preferred to the traditional deviations from means specification in order to facilitate recursive analysis<sup>4</sup>. We present two types of estimate of the standard errors: heteroscedasticity consistent standard errors (HCSE) proposed by White (1980) and those obtained from a bootstrap procedure using residual block re-sampling (see for example Brownstone and Valetta, 2001). We provide both types of standard error since the HCSE are valid asymptotically and here we have forty-eight states, albeit over a number of years. Furthermore, because the error term in the first difference equation may not be serially uncorrelated, using the block residual bootstrap procedure retains any temporal dependence there may be in the residual.

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<sup>4</sup> Similar results for the overall period are obtained when the within-group estimator (variables expressed as deviations from time means) is used.

We first estimate equation (1) for the period 1984 to 1989, a period in which there were no hikes in the federal minimum. The year 1984 rather than an earlier year is chosen since among the states used in this study, the first state minimum wage hike after the 1981 federal increase was in 1985 (in Maine). The results in the first column of Table 2 indicate that overall there is a positive effect of minimum wage increases on teenage employment, and the coefficient is significantly different from zero using both types of standard error. State-level minimum wage hikes did not have adverse effects on employment – if anything employment increased as a result of them. In order to investigate the robustness of this finding, we estimated the equation separately for each year beginning with 1984-5. The results in the second to sixth columns of Table 2 indicate that the estimated impact of minimum wage hikes is positive in 1985, 1986 and 1988 and negative in 1987 and 1989. The 1987 minimum wage coefficient is negative and significantly different from zero on the basis of the heteroscedasticity consistent standard errors, though not significant when the bootstrap method is used. Five states raised their minima in that year – four by 10 cents (less than 3%) and the state of Vermont by 38 cents. Closer examination reveals that the sizeable estimated coefficient is due mainly to a very large employment effect associated with the 10 cent hike in Rhode Island (see Appendix Table A.1). Such large effects from small increases in the minimum wage are difficult to believe. In Table 3, the results obtained by estimating equation (1) recursively (beginning with 1984-5 and adding each year to the sample) are presented. In all recursions the minimum wage effect is positive except for 1984-7 when it is negative though not significant.

As a further robustness check for the overall period 1984-9, following Burkhauser et al. (2000), we add the lagged minimum wage hike in order to examine any delay in the impact on employment. This gives rise to a distributed lag relationship:

$$\Delta E_{st} = \beta_1 \Delta U_{st} + \beta_2 \Delta P_{st} + \beta_3 \Delta w_{st} + \theta_1 \Delta m_{st} + \theta_2 \Delta m_{s(t-1)} + \Delta \varepsilon_{st}$$

This relationship is estimated for the period 1985-89 since we lose a time period when creating the lagged term. The overall effect of a minimum wage hike is given by  $\theta_1 + \theta_2$ . While the lagged term has an estimated negative coefficient (Table 3, column 6), it is not significant and is more than outweighed by the positive current year effect.

As a final robustness check, we replace the term  $\Delta m_{st}$  by a dummy variable  $D_{st}^j$  for each state-level minimum wage increase ( $j = 1, 2, \dots, J$ ). We define  $D_{st}^j = 1$  for a minimum wage increase in state  $j$  (in which case  $s = j$ ) in year  $t$ , and  $D_{st}^j = 0$  for state  $s \neq j$  for all  $t$ , and for state  $j$  for years other than  $t$ . All increases in state minima are treated in this way whatever their size, and the following equation is estimated for the period 1984-9:

$$\Delta E_{st} = \alpha_1 \Delta U_{st} + \alpha_2 \Delta P_{st} + \alpha_3 \Delta w_{st} + \sum_{j=1}^J \delta_j D_{st}^j + \Delta \eta_{st} \quad (2)$$

If we restrict our attention to the cases where the HCSE and bootstrap standard errors concur, this approach suggests that there may have been significant effects on employment in five of the twenty-six minimum wage hikes included in the analysis (see Table 4). However, the coefficient is positive in three cases where the impact is significant. One of the two significant negative effects occurs for Rhode Island following the 1987 minimum wage hike and offsets a significant positive impact for the 1986 hike in the same state. The only ‘pure’ negative impact is found for the 1988 hike in New Hampshire when the minimum wage was raised by just ten cents from \$3.35 to \$3.45. On the basis of the evidence presented here it is apparent that state-level minimum wage hikes in general had no significant negative effects on employment during the 1980s.

#### **IV. The impact of federal and state minimum wage hikes in the 1990s**

In order to evaluate the effect of the federal minimum wage hike of April 1990 from \$3.35 to \$3.80, we begin by re-estimating equation (1) for the year 1990 only. There is a statistically significant (and negative) effect due to the minimum wage (Table 5, column 1). The estimated coefficient of -0.175 translates into an elasticity figure of -0.36 and this is not of line with the elasticities reported by Burkhauser et al. (2000) and Bazen and Marimoutou (2002). Note that the minimum wage variable is the difference  $\log(3.80) - \log(3.35)$  for states which have not had increases since the 1981 federal hike and a smaller value,  $\log(3.80) - \log(\text{state minimum})$ , for other states, except where the state minimum was already above 3.80. In order to further explore the state-federal dichotomy, we next create a separate variable for state-level and federal minimum increases.



For the increase in federal minimum we define the variable:

$$FED = \max (DMW, 0)$$

where  $DMW = \{ \log (3.80) - \log (\max [3.35, \text{state minimum}]) \}$  x dummy for 1990 (if the state minimum is less than \$3.80).

For state-level increases we define the variable:

$$STATE = \Delta m_{st} \text{ x dummy for 1985-9}$$

This enables us to test to see whether state and federal minimum wage increases have similar effects in the following equation:

$$\Delta E_{st} = \lambda_1 \Delta U_{st} + \lambda_2 \Delta P_{st} + \lambda_3 \Delta W_{st} + \theta_S STATE_{st} + \theta_F FED_{st} + \xi_{st} \quad (3)$$

In the second column of Table 5, the estimation results from the equation with these separate minimum wage variables using data for the years 1984-90 are presented. The coefficient on state minimum wage variable is positive and significant. The federal variable on the other hand is highly significant and negative on the basis of both types of standard error.

It is clear then that the 1990 federal minimum wage hike did have a statistically significant and negative impact on teenage employment. This finding is further reinforced by including the hike that took the federal minimum from \$3.80 in 1990 to \$4.25 in 1991. When equation (1) is estimated for 1990 and 1991 combined (column 3), the minimum wage effect is similar to that for 1990 in size and statistically significant. When the state and the two federal minimum wage increases are entered separately along the lines of equation (3), the state minimum wage variable is positive and significant while both federal hikes are found to have significant, negative effects on teenage employment (column 4) – although the bootstrap standard errors suggest that the second hike is not be significant at 5%. In the final column, the minimum wage hikes for 1990 and 1991 are replaced by year-specific dummies in equation (1) as in Deere et al (1997). The equation is estimated for 1989-91 and the previous results are confirmed.

The conclusion that emerges for the 1980s and early 1990s is that federal hikes have a significant negative effect on teenage employment whereas increases in state minima do not. We now examine what happened after 1991 in order to see whether the same conclusion holds. The next rise in the federal rate which was implemented in 1996 and between 1992 and 1995, there were only four state-level minimum wage increases – see Figure A.1. One of these is the increase from \$4.25 to \$5.05 in New Jersey is the basis of the research undertaken by Card and Krueger (1994) and is perhaps the key study underlying the ‘new economics of the minimum wage’.

We proceed as before by estimating equation (1) for the period 1992-95 in which there were only four state-level increases (Table 6, column 1). The minimum wage coefficient is positive and insignificant, and in line with the earlier finding that state minimum wage hikes have no effect on teenage employment. The same equation is estimated for the year 1996 alone when the federal minimum wage was raised to \$4.75, the coefficient is negative and significantly different from zero on the basis of the HCSE but not when bootstrap standard errors are used (column 2). Including data for 1997 when there was a further hike does not alter this conclusion (column 3). The implied elasticity is -0.25, which is smaller in absolute value than the figure for the 1990-91 hikes. Estimating the equation with separate state and federal minimum wage effects using equation (3) confirms these findings (columns 4 and 5). The period after 1991 therefore provides additional support for the conclusion that state minimum wage increases do not have any significant negative impact on teenage employment. However, the statistical significance of the estimated negative effect of the federal hikes in 1996 and 1997 is not established.

#### **V. Why do state-level minimum wage hikes have no detrimental effect on teenage employment?**

Given the dichotomy between the effects of state-level and federal minimum wage hikes, it is important to understand what is driving this apparently robust result. A number of explanations are possible and we suggest three. First it has already been pointed out that during the 1980s most of the state-level minimum wage increases were not only implemented in the New England states but also the same states in general increased their minimum wage a number of times by fairly small increments (see Figure A.1). The only substantial increases (of more than 10% in a given year) were in California, Connecticut and Washington. When

the federal minimum was increased it rose by 13% in 1990, 12% in 1991, 12% in 1996 and 8% in 1997. These are fairly substantial increases over period of two years, especially the 1990-91 hikes, and it is not unexpected that they had an impact on employment whereas the smaller state-level increase did not. A second and related possibility is that for states which either have no minimum wage apparatus or decided simply not to raise their minimum rates in the 1980s, the federal minimum wage hikes of 1990 and 1991 represented a regime change. During the period in which the federal minimum was frozen, employers may have adopted different approach to recruitment and retention. When this regime came to an end and an effective wage floor was reinstated, employers reverted back to their previous behavior. Hikes in the federal minimum create abrupt regime changes and as a consequence have adverse effects on employment. A gradualist approach in which minimum wages are raised regularly by small amounts thereby maintaining a floor to wages does not give rise to significant employment impact as firms operate within a stable regime. This would seem to be borne out with the introduction of the national minimum wage in the United Kingdom, where the minimum has been increased regularly over a number of years from a low initial level without having adverse effects on employment (see Metcalf, 2002). A third type of explanation is that state-level wage hikes have only microeconomic and thus limited effects, whereas economy-wide federal hikes have macroeconomic consequences on employment. One story might be that firms attempt to maintain profit margins following the federal minimum wage hike and create inflationary pressure that is not accommodated by the monetary authorities, so that there is an adjustment in terms of employment. This kind of outcome would not occur with state-set minimum wages.

## **Conclusions**

By examining the impact of minimum wage hikes in a recursive manner, we are able to show that during the 1980s and 1990s, state minimum wage increases in general had no significant negative impact on teenage employment whereas federal hikes did. This asymmetry is capable of explaining why studies finding conflicting results. The new economics of the minimum wage, which is based on the idea that the latter does not have adverse effects on employment, is founded on case studies of state-level minimum wage hikes. Recent studies that find a negative impact on employment examine (or include in the analysis) federal hikes. The state-federal dichotomy could therefore be the answer to the puzzle of why studies find conflicting results.

## References

Bazen, Stephen and Velayoudom Marimoutou (2002), "Looking for a needle in a haystack? A re-examination of the time series relationship between teenage employment and minimum wages in the United States", *Oxford Bulletin of Economics and Statistics*, Vol 64, 699-725.

Brown, Charles, Curtis Gilroy and Andrew Kohen (1982), "The effect of the minimum wage on employment and unemployment", *Journal of Economic Literature*, Vol 20, 487-528.

Brown, Charles, Curtis Gilroy and Andrew Kohen (1983), "Time series evidence on the effect of the minimum wage on teenage employment and unemployment", *Journal of Human Resources*, Winter, Vol 18, 3-31.

Brownstone, David and Robert Valetta (2001), "The bootstrap and multiple imputations: Harnessing increased computing power for improved statistical tests", *Journal of Economic Perspectives*, Vol 15, No 4, 129-141.

Burkhauser, Richard, Kenneth A. Couch and David C. Wittenberg (2000), "A reassessment of the new economics of the minimum wage literature using monthly data from the CPS", *Journal of Labor Economics*, October, Vol 18, 653-702.

Card, David (1992), "Using regional variation in wages to measure the effects of the federal minimum wage", *Industrial and Labor Relations Review*, Vol 46, 22-37.

Card, David and Alan Krueger (1994), "Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania", *American Economic Review*, Vol. 84, 772-793.

Card, David and Alan Krueger (1995), *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press, New Jersey, 1995.

Card, David and Alan Krueger (2000), "Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: Reply", *American Economic Review*, Vol. 90, 1397-1420.

Deere, Donald, Kevin Murphy and Finis Welch (1995), "Employment and the 1990-1991 minimum wage hike", *American Economic Review, Papers and Proceedings*, Vol 85, 232-237.

Kennan, John (1996), "The elusive effects of minimum wages", *Journal of Economic Literature*, Vol 33, 1949-1965.

Manning, Alan (2003), *Monopsony in Motion*, MIT Press, Cambridge MA.

Metcalf, David (2002), The national minimum wage: Coverage, impact and future, *Oxford Bulletin of Economics and Statistics*, Vol 64, 567-582.

Neumark, David and William Wascher (1992), Employment effects of minimum wages and subminimum wages: Panel data on state minimum wage laws, *Industrial and Labor Relations Review*, Vol 46, 55-81.

Neumark, David and William Wascher (2000), "Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: Comment", *American Economic Review*, Vol 90, 1362-1396.

Williams, Nicolas and Jeffrey Mills (2001), "The minimum wage and teenage employment: Evidence from time series", *Applied Economics*, Vol 33, 285-300.

White, Halbert (1980), "A heteroskedastic-consistent covariance matrix estimator and a direct test for heteroskedasticity", *Econometrica*, Vol 48, 817-838.

<b>Table 1: Means* and standard deviations of the variables used</b>					
	<i>1984</i>	<i>1989</i>	<i>1991</i>	<i>1995</i>	<i>1997</i>
<i>Teenage employment population ratio</i>	0.446 (0.071)	0.484 (0.066)	0.426 (0.079)	0.446 (0.089)	0.434 (0.092)
<i>Average earnings in dollars</i>	8.94 (0.89)	10.15 (1.16)	10.85 (1.19)	12.13 (1.02)	12.65 (1.03)
<i>Unemployment rate (%)</i>	5.42 (1.93)	2.86 (0.81)	4.14 (1.12)	0.77 (0.03)	0.76 (0.04)
<i>Teenage to adult population ratio</i>	0.1 (0.007)	0.09 (0.008)	0.084 (0.007)	0.084 (0.011)	0.088 (0.010)
<b>Mean annual variations</b>					
	<i>1984-89</i>	<i>1989-91</i>	<i>1991-95</i>	<i>1995-7</i>	
<i>Teenage employment population ratio</i>	+ 0.007 (0.03)	-0.028 (0.04)	+0.005 (0.03)	-0.006 (0.033)	
<i>Average earnings in dollars</i>	+0.26 (0.28)	+0.32 (0.25)	+0.32 (0.41)	+0.29 (0.36)	
<i>Unemployment rate (%)</i>	-0.5 (0.96)	+0.63 (0.81)	-0.84 (1.82)	-0.009 (0.32)	
<i>Teenage to adult population ratio</i>	-0.002 (0.005)	-0.003 (0.005)	+0.0001 (0.005)	+0.002 (0.006)	
* Weighted by state population levels. Standard deviations in parentheses.					

<b>Table 2: Estimates of the state minimum wage effects on teenage employment 1984-9 – model in first differences</b>						
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>
	<i>1984-9</i>	<i>1984-5</i>	<i>1985-6</i>	<i>1986-7</i>	<i>1987-8</i>	<i>1988-9</i>
<i>Minimum wage</i>	0.168** (0.057) [0.141]	0.650** (0.217) [1.332]	1.086** (0.327) [0.621]	-0.576** (0.163) [0.305]	0.237** (0.031) [0.157]	-0.173 (0.189) [0.213]
<i>Unemployment rate</i>	-0.0053** (0.0019) [0.0032]	0.003 (0.005) [0.0067]	-0.006* (0.003) [0.0076]	-0.006 (0.004) [0.0061]	-0.008 (0.0053) [0.0073]	-0.006* (0.0029) [0.0056]
<i>Teenage population ratio</i>	-0.634 (0.483) [0.648]	-2.124* (1.04) [1.510]	0.611 (0.609) [1.191]	-1.166 (0.667) [1.170]	0.728 (1.050) [1.136]	-2.101 (1.786) [1.732]
<i>Average earnings</i>	0.085 (0.059) [0.089]	-0.078 (0.107) [0.164]	-0.187 (0.076) [0.212]	0.302** (0.115) [0.171]	0.311* (0.143) [0.188]	-0.082 (0.129) [0.283]
<i>Uncentred R<sup>2</sup></i>	0.115	0.101	0.174	0.277	0.427	0.134
<i>Number of observations</i>	240	48	48	48	48	48
Heteroscedasticity consistent standard errors (HCSE) in parentheses. Bootstrap standard errors in square brackets. * (**) significant at 5% (1%) with HCSE.						

<b>Table 3: Recursive estimates of the effects of state-level minimum wage hikes 1984-89 – model in first differences</b>						
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>
	<i>1984-9</i>	<i>1984-5</i>	<i>1984-6</i>	<i>1984-7</i>	<i>1984-8</i>	<i>1985-9</i>
<i>Minimum wage</i>	0.168** (0.057) [0.141]	0.650** (0.217) [1.337]	0.757* (0.327) [0.562]	-0.079 (0.234) [0.262]	0.221** (0.027) [0.150]	0.165** (0.059) [0.121]
<i>Minimum wage lagged one year</i>						-0.059 (0.059) [0.156]
<i>Unemployment rate</i>	-0.0053** (0.0019) [0.0032]	0.003 (0.005) [0.0067]	-0.004 (0.003) [0.0056]	-0.005 (0.003) [0.0048]	-0.0059* (0.0028) [0.0038]	-0.0063** (0.0019) [0.0033]
<i>Teenage population ratio</i>	-0.634 (0.483) [0.648]	-2.124* (1.04) [1.510]	-0.923 (0.609) [0.984]	-0.811 (0.491) [0.730]	-0.478 (0.468) [0.722]	-0.500 (0.536) [0.685]
<i>Average earnings</i>	0.085 (0.059) [0.089]	-0.078 (0.107) [0.164]	0.047 (0.076) [0.114]	0.078 (0.073) [0.093]	0.111 (0.065) [0.081]	0.121 (0.075) [0.100]
<i>R<sup>2</sup></i>	0.115	0.10	0.072	0.066	0.17	0.156
<i>Number of observations</i>	240	48	96	144	192	192
<p>Weighted regression estimates using state population level as weights.  Heteroscedasticity consistent standard errors in parentheses.  Bootstrap standard errors in square brackets.  * (**) significant at 5% (1%).</p>						



**Table 4: Estimates of state minimum wage hikes 1984-89  
– dummy variable specification**

<i>Maine 1985</i>	0.0059 (0.0034) [0.039]	<i>Connecticut 1988</i>	0.111** (0.0077) [0.039]
<i>Maine 1986</i>	0.012** (0.0045) [0.037]	<i>Rhode Island 1988</i>	-0.009** (0.0035) [0.034]
<i>Rhode Island 1986</i>	0.126** (0.005) [0.037]	<i>Minnesota 1988</i>	0.024** (0.0051) [0.034]
<i>Massachusetts 1986</i>	0.018** (0.005) [0.036]	<i>California 1988</i>	0.052** (0.0027) [0.035]
<i>Vermont 1986</i>	0.096** (0.0066) [0.037]	<i>New Hampshire 1989</i>	-0.014** (0.0042) [0.039]
<i>Maine 1987</i>	-0.026** (0.0025) [0.031]	<i>Maine 1989</i>	-0.055** (0.0037) [0.039]
<i>New Hampshire 1987</i>	0.004 (0.005) [0.031]	<i>Rhode Island 1989</i>	0.064** (0.0028) [0.038]
<i>Rhode Island 1987</i>	-0.108** (0.0028) [0.030]	<i>Pennsylvania 1989</i>	0.0015 (0.0049) [0.039]
<i>Massachusetts 1987</i>	-0.020** (0.0032) [0.031]	<i>Minnesota 1989</i>	-0.074** (0.0014) [0.039]
<i>Connecticut 1987</i>	-0.040** (0.0022) [0.030]	<i>Vermont 1989</i>	-0.056** (0.0046) [0.039]
<i>Vermont 1987</i>	0.039** (0.0032) [0.028]	<i>Washington 1989</i>	0.015** (0.0055) [0.039]
<i>New Hampshire 1988</i>	-0.116** (0.0032) [0.034]	<i>Oregon 1989</i>	0.045** (0.0048) [0.039]
<i>Vermont 1988</i>	0.039** (0.0031) [0.036]	<i>R<sup>2</sup></i>	0.231
<i>Massachusetts 1988</i>	-0.020** (0.0025) [0.033]	<i>Number of observations</i>	240

Weighted regression estimates using state population level as weights.

Heteroscedasticity consistent standard errors in parentheses.

Bootstrap standard errors in square brackets.

\* (\*\*) significant at 5% (1%).

<b>Table 5: Different tests of the impact of the federal minimum wage hikes in 1990 and 1991 – model in first differences</b>					
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
	<i>1990 only</i>	<i>1984-90</i>	<i>1990-1</i>	<i>1984-91</i>	<i>1989-91</i>
<i>Minimum wage</i>	-0.175** (0.06) [0.074]	-	-0.173** (0.065) [0.069]	-	-
<i>STATEMIN</i>	-	0.171** (0.064) [0.032]	-	0.173** (0.063) [0.074]	-
<i>FED (1990)</i>	-	-0.231** (0.048) [0.075]	-	-0.223** (0.048) [0.074]	-
<i>FED (1991)</i>	-	-	-	-0.255** (0.052) [0.157]	-
<i>Unemployment rate</i>	-0.011 (0.013)	-0.0060* (0.00019) [0.0027]	-0.0095** (0.002) [0.0062]	-0.0067** (0.0002) [0.074]	-0.0009 (0.0052) [0.006]
<i>Teenage population ratio</i>	-0.145 (1.331)	-0.556 (0.428) [0.508]	+0.183 (0.409) [1.024]	-0.412 (0.404) [0.074]	-0.032 (0.817) [1.112]
<i>Average earnings</i>	-0.102 (0.144)	0.060 (0.054) [0.065]	-0.094 (0.165) [0.186]	0.050 (0.054) [0.074]	0.115 (0.163) [0.207]
<i>Year = 1990</i>	-	-	-	-	-0.030** (0.0096) [0.012]
<i>Year = 1991</i>	-	-	-	-	-0.036** (0.0092) [0.011]
<i>R<sup>2</sup></i>	0.286	0.163	0.339	0.212	0.429
<i>Observations</i>	48	288	96	336	96

<b>Table 6: Tests of the impact of state and federal minimum wage hikes in 1992-7</b>					
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
	<i>1991-5</i>	<i>1996</i>	<i>1996-7</i>	<i>1991-96</i>	<i>1991-97</i>
<i>Minimum wage</i>	0.009 (0.014) [0.267]	-0.123* (0.046) [0.078]	-0.109* (0.047) [0.069]	-	-
<i>STATEMIN</i>	-	-	-	0.008 (0.016) [0.153]	0.009 (0.013) [0.179]
<i>FED (1996)</i>	-	-	-	-0.115* (0.040) [0.075]	-0.111* (0.040) [0.091]
<i>FED (1997)</i>	-	-	-	-	-0.109 (0.077) [0.092]
<i>Unemployment Rate</i>	-0.0019 (0.0013) [0.0065]	-0.0033 (0.011) [0.016]	-0.0012 (0.0093) [0.017]	-0.0018 (0.0012) [0.0024]	-0.0019 (0.0012) [0.0025]
<i>Teenage population ratio</i>	0.345 (0.592) [1.221]	0.476 (0.630) [1.067]	0.174 (0.571) [0.783]	0.412 (0.459) [0.655]	0.276 (0.417) [0.579]
<i>Average earnings</i>	0.122* (0.055) [0.145]	0.191 (0.160) [0.196]	0.128 (0.122) [0.188]	0.131* (0.051) [0.070]	0.121* (0.052) [0.070]
<i>R<sup>2</sup></i>	0.077	0.180	0.071	0.094	0.075
<i>Observations</i>	192	48	96	240	288
Weighted regression estimates using state population level as weights; heteroscedasticity consistent Bootstrap standard errors in square brackets. Standard errors used (* significant at 5% ** significant at 1% with HCSE).					

**Table A.1: Effects of state minimum wage hikes in 1987**

<i>State minimum wage hikes in 1987</i>	<i>Minimum wage coefficient</i>
New Hampshire (+10c)	-0.660 (0.337)
Vermont (+10c)	+0.728** (0.209)
Massachussetts (+10c)	-1.176** (0.23)
Maine (+10c)	-1.352** (0.174)
Connecticut (+38c)	-0.434** (0.049)
Rhode Island (+10c)	-4.228** (0.172)

Figure 1: Teenage employment and state-level minimum wage increases, 1985-89

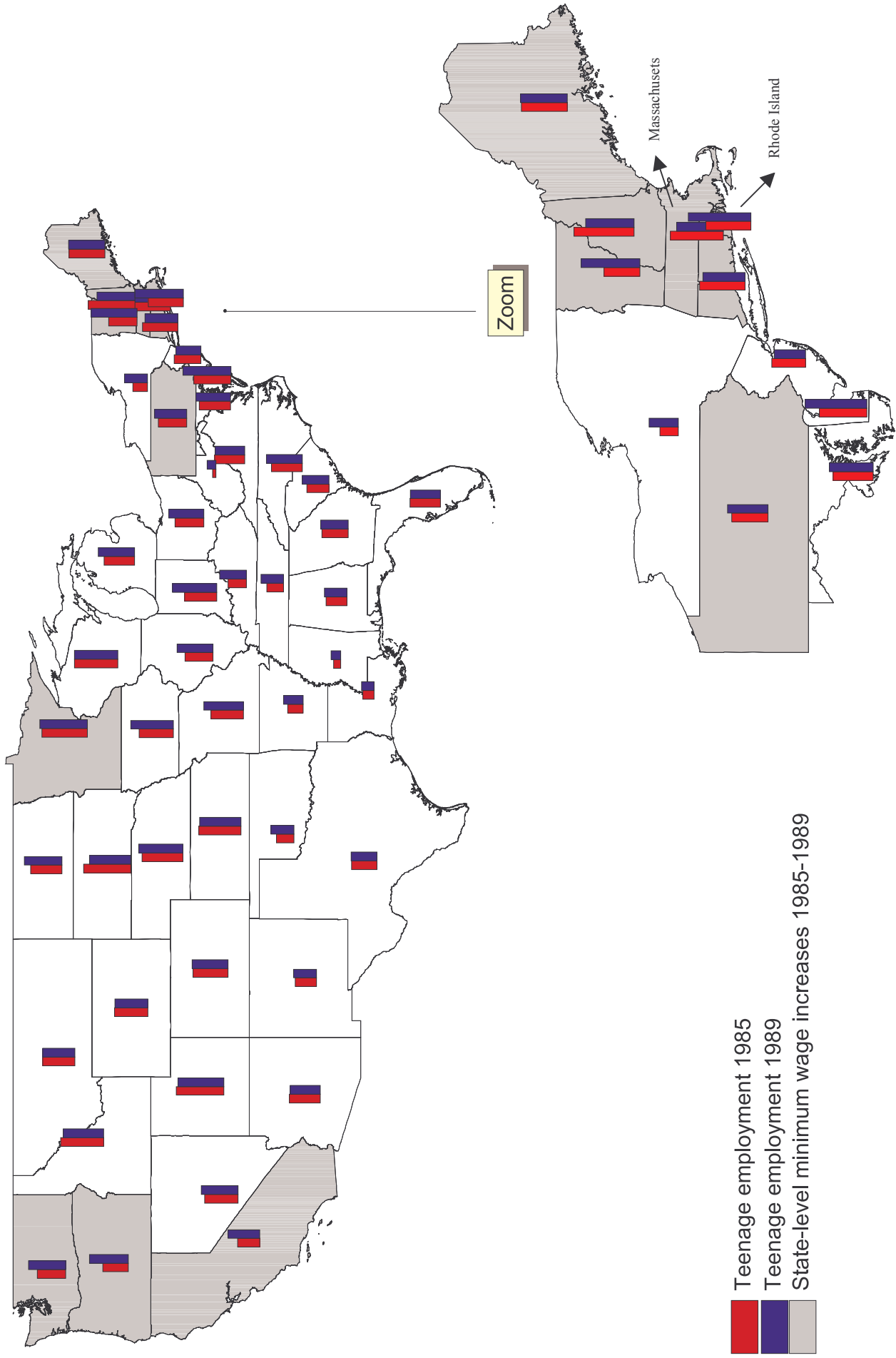


Figure 2: Teenage employment and state-level minimum wage increases, 1992-95

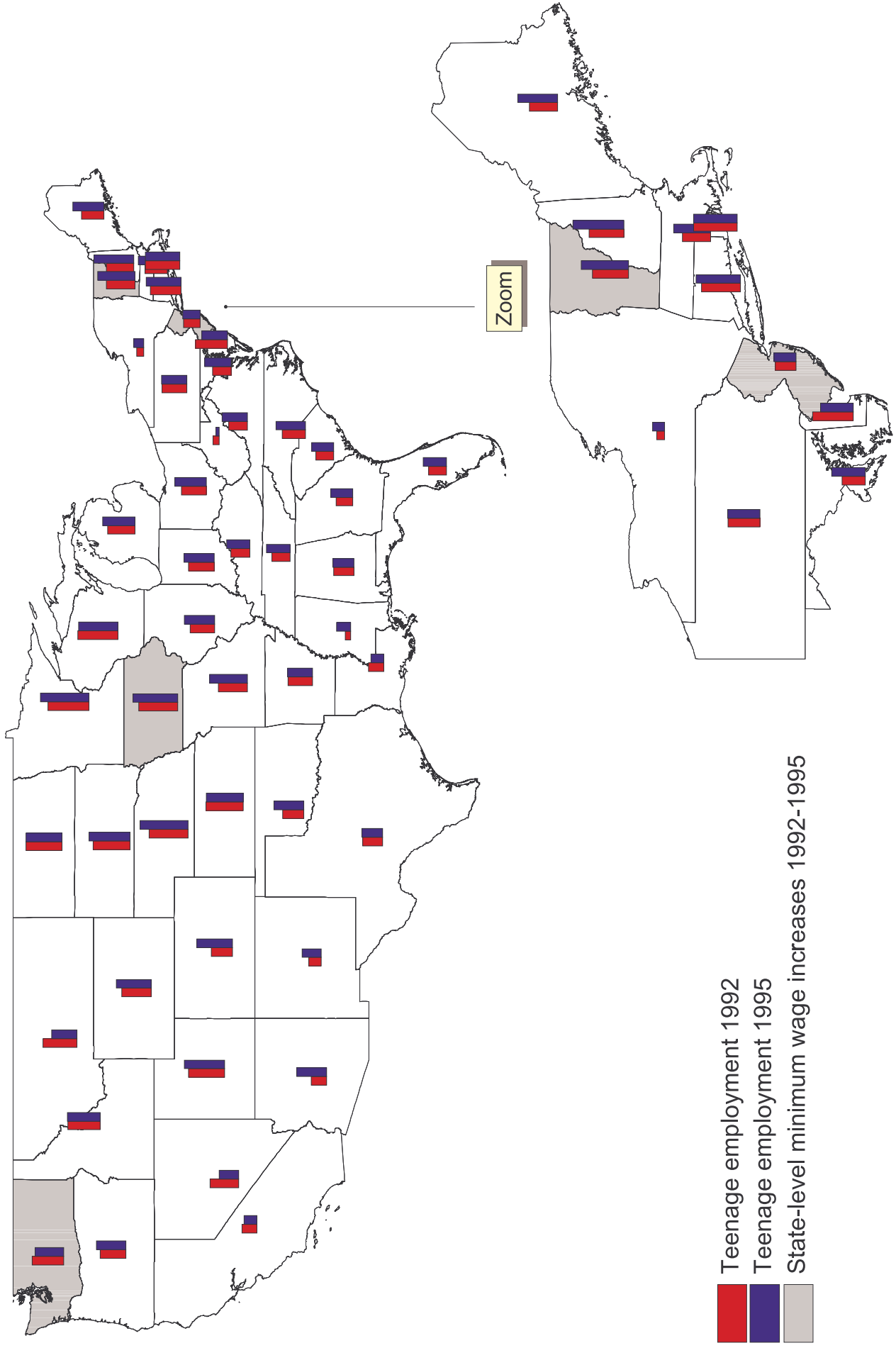


Figure A.1: State-level minimum wage increases 1985-1996

